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An English Vertical Milling Machine.

We present on this page an engraving of a vertical milling machine, which, though it possesses several features familiar to American machinists, yet has certain points of design peculiar to English practice.

It is intended both as a manufacturing tool and for general machine shop use, its manufacturer, Alfred Herbert, of Coventry, England, stating that he has found it in his shop a very efficient and convenient substitute for the planer in many operations, and it is used successfully on typewriter, bicycle and a large variety of other work, using end mills from ¼ inch to 2½ inches diameter.

As will be seen, the column is a single casting with a gap of sufficient size to permit quite large pieces of work to be operated up. The lower part of the column forms a tank for any lubricant that may be used on the cutters, and when desired there is a pump for re-delivering it to the cutter.

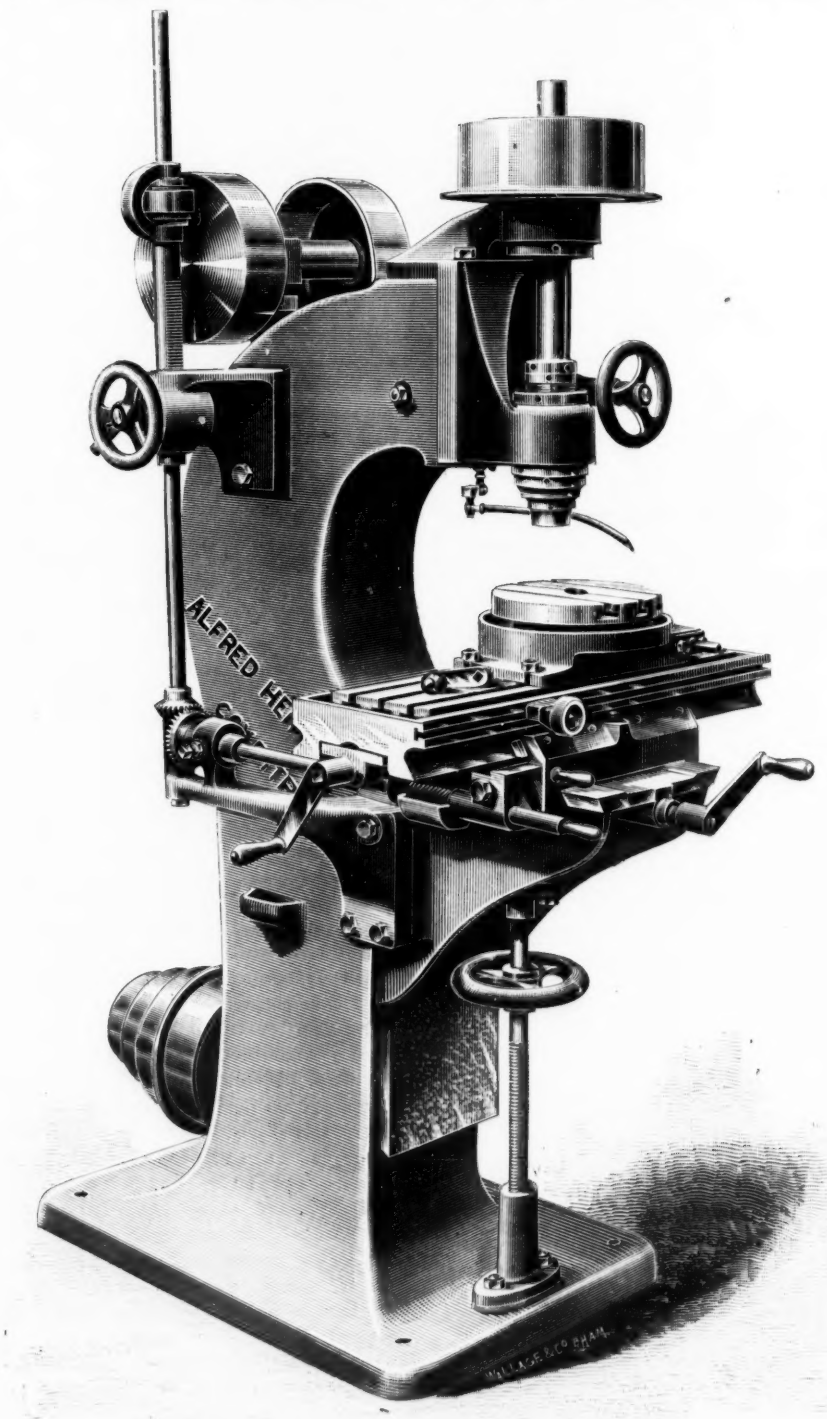
The system of driving and of obtaining the feed motion will be readily understood from the engraving, and it will be seen that the rate of feed can be readily changed while the machine is in motion and without marking the work.

The head which carries the spindle has a vertical movement of 8½ inches by the hand-wheel shown, and this movement is intended for fine adjustment of depth of cut, so that when the knee is placed at approximately the right height it can be firmly clamped to the column. The spindle-carrying slide referred to is counterbalanced by a weight within the column, and there is an adjustable stop by means of which it can always be brought to its original position, as in taking roughing and finishing cuts over a number of pieces with the same cutter.

The spindle is of steel "dead hard" and is finished by grinding inside and out, *i. e.*, its bearings and taper hole for cutters, the latter having also an internal thread by which cutters are drawn in and held firmly, and cannot be loosened by the vibration of heavy cuts.

The spindle runs in phosphor bronze boxes which are adjustable for wear without affecting the alignment, and thrust is taken on a hardened steel ball collar.

The table is 34 inches by 9 inches, has a traverse of 18 inches, a movement to and from the column of 9 inches, a vertical movement of 16 inches. Spindle is 1¼ inches diameter, and its maximum distance from table is 16½ inches. The machine weighs about 1,570 pounds.



AN ENGLISH VERTICAL MILLING MACHINE.

Shellac in Watches—Electric and Other Small Motors.

BY W. H. BOOTH.

In discussing the question of treating a drowned watch, Mr. Weber objects to the soaking in alcohol as certain to "loosen the pallet stones which are set in shellac." Now it seems to me that this is rather a condemnation of the system of setting such stones than of the alcohol process. Pallet stones ought not to be simply set in shellac. "This is the weak point in American made watches," said one of the leading makers here to me, when I asked him to point out any one item to illustrate his claim of superiority for his own make. In his make he fixed the jewel in a milled slot in the pallet, in addition to the cementing by lac, and I have had myself actual experience that mere cementing of the jewel without a positive hold is not to be relied on. The jewel becomes loose. You have it fixed by some man who perhaps does not exactly place it as it was before, and the watch ceases to be satisfactory. In my own case a watch which never varied from Greenwich for a whole twelve months has never been so good since. My advice, so far as it is of any good, would be to all makers to nip the pallet jewels in slots. If my recollection serves me, the slotted pallet had an appearance as shown on page 2, but, of course, much smaller.

Mr. Richards has given us some interesting information as to the use of compressed air, including something on carpet cleaning. He says carpets can be cleaned in London by this process. I thought so myself at one time, and on changing my residence, sent off our little lot for air treatment. When they came back they looked no better for their treatment, were very decidedly no cleaner than when they set out, and out of one of them there tumbled pieces of a letter which I had torn up on the morning we sent the carpets away from the old house. This experience has left me to doubt one of two things—the efficiency of compressed air or the *bona fides* of the cleaning company.

I have had the pleasure of meeting, this week, Mr. John E. Sweet, of Syracuse, N. Y., who is over here for a spell. If Mr. Sweet sees anything on this side which seems to him better than its fellow on your side, you may expect to hear of it. I can only regret that circumstances have prevented my having a longer time with Mr; Sweet than we were enabled to have.

As an illustration of what can be done in the way of small motors, apart from the electric motor that is out of the reach of such as do not live upon an electric light route, I have seen a gas motor that to me is new. It is a small vertical engine operating on the Otto cycle, and running at a high speed, the ¼ horse engine running up to 1,200 revolutions per minute, which implies, at full power, no fewer than ten explosive strokes per second. The governor is of the fly-wheel type, and regulates well. The ignition tube, of porcelain, heated in a little refractory tube by a Bunsen flame. Though so highly speeded, the engine was perfectly steady and did not look to weigh more than 56 pounds.*

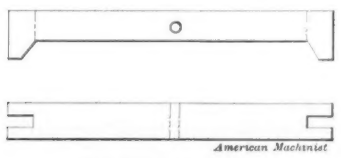
There is simply one valve, the gas inlet valve, the spindle of which is the only moving part visible besides the fly-wheel, all the parts presumably being covered and opened by the piston itself. A retail price of $30 does not look excessive for a motor like this, really well made and operating on an economical basis.

Until the electric companies show the courage of their convictions, or of their expressed opinions, that the electric light is the cheapest form of light, and carry their mains along the residential streets there will be a chance for small heat motors. But our English electric lighting companies are short of energy. They avoid every street in which they do not get a promise from the inhabitants before laying their mains, which is much as though a machine shop refused to build a new line of tools until they got a few score signed orders. They quite overlook that once electricity is laid on people will want to have it, and would also make use of it for power as well as for light. Electric motors of large size are coming more and more into use for machinery-driving in manufacturing industries, for the purpose of avoiding shafting and steam pipes. The use of separate steam engines for individual machines is enormously wasteful. Such engines are usually of a non-economical type, receive but poor attention, and are fed with steam reduced to a very wet condition by passage through long pipes from a distant boiler. In electrical transmission a loss of 20 per cent. is quite a big thing, and if the central engine be fairly large and economical, the final result cannot fail to be in favor of electrical methods. One result of electrical transmission will be to improve the position of old-fashioned works where the order and position of the various buildings are irregular and unsuited for shafting. I think that makers of machinery have got to recognize this, and that the small uneconomical steam engine has got to go and make room for engines of a better class and electric transmission, the

*I find later it weighs only 60 pounds packed, and occupies a space 10"x10"x16" high.

drawback to which, however, is the first cost.

Electric motors of several horse-power appear to cost about $50 per horse-power. Where it is sought to drive electrically merely for the sake of perfect balance and the abolition of belt pull, the cost is likely to prove a bar to the adoption of the system. A recent writer puts the cost of steam at



SLOTTED PALLET.

14 pounds per I. H. P. for Corliss engines. The loss of efficiency is given as 10 per cent. in the engine, 10 in the dynamo, 2 in the lines, and 15 per cent. in the motor, or a final efficiency at the motor pulley of 63 per cent. of the engine power. Thus with a good central engine the steam per I. H. P. at the motor pulley will be 19.18 pounds.

He then takes a case of a works with the usual distributed steam engines, with an average steam consumption of nearly 51 pounds per I. H. P. To this is added the steam pipe condensation, making a total of 55 pounds. This is hardly fair to the steam engines. They were old as against the new electric plant, and it may be argued that a renewal of the engines on a modern plan, and a remodelling of the pipes would tell a different tale. While this may be so it would be difficult to get a horse-power at each machine for less than 20 pounds of steam per hour, especially if the steam pipes were long, and the economy is clearly with the electrical system.

Again, it was found in an engine works that 59 per cent. of the power of the engine was absorbed by shafts and belts, so that there would be no prospect of shafting comparing with electric leads. In two other shops the power absorbed was 42 and 75 per cent. It is then pointed out how the abolition of shafts and the separate driving of heavy machines makes it possible to economize in the building in the way of walls or columns that need no longer stand the pull of belting. All this strongly points to the need for careful consideration by mechanical engineers of the new facts and conditions that are now before them.

The system of machinery driving has varied very little indeed since Fairbairn, of Manchester, introduced light pulleys and quickly rotating wrought-iron shafts in place of the old wooden pulleys and square shafts he found holding the field. The existing system is half a century old, and it is not surprising that there is a prospect of it being changed. In my own practice it has several times of late seemed correct to recommend electricity as the means of conveying power, notably in the case of a pump placed out in a field which is driven by a motor from an electric light plant. The speed of the motor being about 800, I required to use a countershaft to reduce the speed to the pump, but had I not been pressed for time in the completion of the work, there seems no reason why a worm on the motor spindle should not have driven the pump crank shaft direct, so abolishing all intermediate gearing. The objection to the worm gear is the end thrust, and the small amount of surface contact for a high rate of rubbing contact. Both of these faults can be diminished; one indeed abolished altogether by using a right and a left threaded worm and two wheels with additional toothed rims, without tooth play, cast on them to compel each worm to do its share of the total work. This would be simpler than the gearing necessary to reduce about forty-fold from a high speed motor. The great beauty of the motor, however, comes in where you want to drive at high speed, and put the motor direct upon the driven spindle and save the belting up with its side pull and friction.

A New Multiple Spindle Drilling Machine.

We present on this page illustrations of a new multiple spindle drilling machine, intended mainly for manufacturing operations, and to drill almost any required number of holes with any desired grouping, and of various sizes and depths; these it drills in about the same time as would be required to drill the largest or deepest with a single-spindle drill.

No jig is usually employed with the machine, though, of course, one can be used if it is preferred or is necessary.

Motion is given to the various spindles by means of cranks, which are formed on their upper ends, these cranks engaging with a plate, which may be called a wrist-plate, and is given the required circular motion by a crank, which is formed on the lower end

A NEW MULTIPLE DRILLING MACHINE.

of the main spindle, so that the plate serves merely as a connection for the various cranks, and performs the same office as is performed by the side rods of a locomotive, and in the same manner.

By this construction, there is scarcely any limit to the number of holes that can be drilled simultaneously, and, in fact, we have before us photographs of a machine

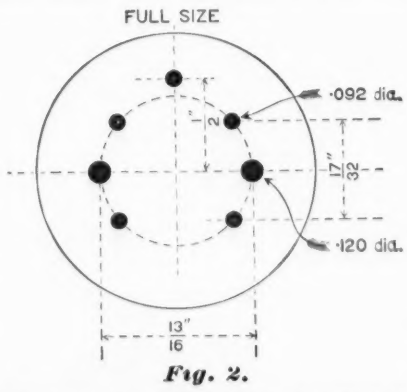


Fig. 2.

built upon the same principle, in which the wrist plate is extended laterally until it becomes a long bar and gives motion to 162 drill spindles, arranged in a double straight row. The particular machine illustrated is for drilling the back end of a Bell telephone receiver case, and the spindles are arranged as shown by the diagram, Fig. 2, which is full size.

The action of these machines being perfectly balanced, is smooth and noiseless, and they can be run as high as 2,500 turns a minute. Being driven entirely by one pulley, all complications of belts and gearing are avoided, and each drill is as strongly driven as if inserted in the end of the main spindle. All spindles are automatically lubricated from a single oil cup.

On the table of the machine is shown a fixture for correctly locating and holding the article to be drilled. Other positions, sizes and numbers of drills can be used on the same machine by simply changing the bearing block and driving plate through which the drill spindles pass. The fixture on the table can also be changed to suit other work.

A very large variety of work can be expeditiously done on these machines, and they have been built for electrical work on wood, fiber and metal, bicycle hubs, guns, sewing machine work, clock frames, etc, locks, hinges, and other hardware, jacquard loom work, perforated metal, brush and novelty work of various kinds. The same system can also be applied for tapping a number of holes at once.

The makers are the Langelier Mfg. Co., 67–69 Clifford street, Providence, R. I.

On the Cultivation of the Inventive Capacity by the Solution of Constructive Problems.

BY LEICESTER ALLEN.

With reference to Problem No. 6 I take this opportunity to say that before it is dismissed I shall present to the readers of the AMERICAN MACHINIST the method of securing the required motion for backing off the teeth of milling cutters, employed on the machine seen by Mr. Miller at the Columbian Exposition at Chicago, and which suggested the problem. In this article I shall also present a couple of solutions of that problem which have been sent in by American contributors. I will, however, begin with a solution of Problem No. 7, contributed by Mr. Geo. N. Dieterich, of Sandwich, Ill. This is shown in elevation and plan in Fig. 1, page 3.

On the shaft C plays the lever B and the wheel A, and an arm E is keyed rigidly to the shaft. To this arm is pivoted at G another lever D. The ratchet wheel is moved as indicated by the arrow when the lever is moved up and down, the pawl F engaging the ratchet during the downward motion of the long arm of the lever. When the end H of the lever B is moved down to the position shown by the dotted outline, and when the wheel A has moved through an arc of $\frac{1}{16}$ of an inch, the pawl F' engages on the opposite side, as shown, and when the lever B is brought to its original position the lever D moves the ratchet $\frac{1}{16}$ of an inch in the same direction as before.

With short pawls this device will operate well only when the lever B moves through short arcs. If the pawl F be made long enough, and be bent so that when the lever is in the initial position shown in full lines, its engaging extremity may extend down 45 degrees, or even 60 degrees below the horizontal line, the amplitude of oscillation could be much increased without materially affecting the operation of the device in other respects, but in any way of carrying out the principle a limit will be reached where the pawl F will pass two teeth while the other pawl only moves the ratchet wheel one tooth, and at this limit the device will cease to operate according to the requirements of the problem.

This may be said generally, I think, of all ratchet wheels moved alternately by separate pawls, and wherein the pawl centers do not move either in arcs concentric with the ratchet wheel, or in which the pawl centers do not move in straight lines tangent to circles concentric with the center of the ratchet wheel, as would be the case where two sliding reciprocating bars carry each a pawl acting alternately to move the ratchet. This would be expressed geometrically by saying that to effect equal motion of the ratchet by alternately acting pawls through any number of degrees of arc, the pawl centers must describe either arcs of the same number of degrees and concentric with the ratchet wheel, or straight lines tangent to such arcs, and the pawl points or "bits" must describe an equal number of degrees of arc in a circle whose center is also that of the ratchet wheel.

Figs. 2 and 3 are respectively a plan and side view of a solution of Problem No. 7, contributed by Mr. C. H. Glasset, Denver, Col.

In this solution A is the ratchet, B and D are rock levers playing freely on the shaft C; F is a frame rigidly fastened to the shaft by set screws G and having its front removed in Fig. 3 to afford a better view of other parts. H and I are pawls pivoted to B and D respectively. On the frame F is formed a hub K, in which works the rock shaft L. The latter rocks on its longitudinal axis and also slides lengthwise in the hub K. Through a boss M on the inner end of the shaft L passes the rock lever N. This lever also passes through and slides freely in bearings formed in the balls O which are fitted into the arms of the rock levers B and D to form ball and socket joints. It is thus seen that when B is moved to actuate the ratchet, D moves oppositely, and its pawl I takes up the same number of teeth as B will take up in moving back to the initial position.

This solution meets all the requirements of the problem, and though somewhat complicated it can be made strong and will work well. It is, of course, too costly a construction to be used in preference to simpler devices that will work equally well.

Figs. 4, 5 and 6 are views of a very ingenious device, worked out by Mr. Charles H. Fogg, of Boston, Mass., as a solution of Problem No. 7. Its compactness and mechanical construction will commend it as a mechanical movement. Referring to Fig. 4, which is a perspective view, A is the spindle, B the ratchet wheel, C and D levers which may turn freely on the spindle. Extending from the spindle is an arm, to a bearing on which is fitted a bevel idle gear. Into this mesh bevel gears G' keyed to C and G'' keyed to D. The lever C may be actuated by the knob H.

In Fig. 5 Mr. Fogg shows how the same result may be obtained by a linkage system. A and G are the pawl arms playing on the spindle, and C is an arm rigidly attached to the fixed spindle by a pin F which also performs the function of a stop. D and D' are links connecting A and G with the equal and opposite arms of the bell crank lever B. H is a knob for actuating the mechanism by hand.

Fig. 6 shows in plan the angular relations of the parts and positions of centers. With reference to these Mr. Fogg writes:

"The arms of the levers A and B are at an angle of 135 degrees; those of the lever B are of equal length with the short arm of the lever A, and just one-half that of the arm C and the link D, both of which are of equal length. The arm C is pinned to the shaft which is stationary as in Fig. 4. When the two radial arms are exactly opposite, each may be moved through an angle of 45 degrees in either direction. The stop-pins E and F prevent locking. It will thus be seen that the motion which either pawl can impart lies within the limit of 45 degrees." These devices are in every way good mechanical constructions and meet completely all the requirements of the problem.

In Fig. 7 is shown a solution contributed by Mr. Fred R. Dawson, of Saxonville, Mass. It is an ingenious arrangement.

A is a rock lever working on the fixed spindle C. To this lever is attached a pawl B and a segmental rack X whose pitch line has the same radius as the pitch line of the ratchet wheel. To the shaft C is keyed the arm D, which at its outer end has a guiding channel E in which slides the segmental rack Z. Meshing with both racks is a pinion F. The motion of A causes the racks X and Z to move alternately in opposite directions through equal angles of their respective circular motions. The engaging points of the pawls, therefore, will move

through equal arcs on the pitch line of the ratchet wheel, and they will therefore actuate the wheel precisely as required to meet the requirements of the problem.

Figs. 8 and 9 are a side view and elevation of a solution of Problem No. 6, contributed by Mr. James P. Hays, of Meriden, Conn. Mr. Hays gives the following explanation of the device:

"On the shaft *a* is a worm-wheel *b* which is fastened to the spur gear *c*, both being loose upon the shaft. Fastened to the shaft *a* is an arm *d* which carries at its opposite end two gears which are fastened together by a shaft *e* that revolves freely on its bearing. The gear *g* drives *f* which is fastened to the end of the splined shaft *h*, which shaft drives the vertical cam shaft.

"Supposing the gear *c* to have 80 teeth, the gears *f* and *g* both having 60 teeth, and the gear *i* 40 teeth. Then for every revolution of *a* and *d*, *i* will make twice, and *h* the same speed as *a*.

"Running in the wheel *b* is a worm *j*, which is driven by the change gears that are to be driven by the lead screw, which worm is for the purpose of modifying the speed of *h*. At *k* and *k'* are shown a pair of miter gears.

"Now, suppose the lead-screw has five threads per inch, and that the lathe is geared up to turn 100 per inch. Then for every revolution of the work the lead-screw will make $\frac{1}{20}$ of a revolution.

"Suppose the mill being backed off has a spiral of one turn in 86 inches; then the gears on the end of the lead-screw being in the proportion of 20 to 36, and the worm wheel having 100 teeth, the shaft *h* will make $\frac{1}{3600}$ of a revolution, more or less than the shaft *a* for every revolution of the mill.

"By simply reversing gears, a right or left-hand spiral mill can be backed off. Change of rates of feed will not affect the working of this mechanism."

It appears to me that this movement, properly designed, can be made to effect all the requirements for giving the backing off tool the action required by the conditions named in the problem.

Solutions to both Problems 6 and 7 have been sent in by a writer who has frequently interested the readers of the AMERICAN MACHINIST over the signature of "Quirk," and who still desires to retain this cognomen. To this there can be no objection so long as his real name is known to the editor. He says he has been much interested in these problems and their solutions. His solution of Problem No. 6 is illustrated by Figs. 10 and 11, and his solutions of Problem No. 7 are shown in Figs. 12, 13, 14, 15 and 16.

This gentleman writes as follows:

"In attempting to solve Problem No. 6, as presented in your issue of May 3d, I am under the disadvantage of not having a copy of the AMERICAN MACHINIST of July 20, 1893. But from the description of the lathe, as given by Mr. Miller and Mr. Allen, I will venture to present one plan, at least, for the mechanism concealed in the 'little box.' First, assume that the lathe has a milling cutter of 20 teeth to back, and that they are spirally cut to a pitch of 30 inches. I assume, also, that the cam is geared so as to give the tool post four vibrations for each turn of the splined shaft that enters the little box. Fixing the lathe feed at 30 turns to an inch, we deduce the following:

"With the pitch of the spiral as given, the splined shaft must make an advance of five revolutions while the rest travels 30 inches—20 ÷ 4 = 5. Then 30 inches ÷ 5 = 6 inches, the point in the spiral where the splined shaft advances one revolution. The lathe spindle, in the meantime, revolves 6 × 30 = 180, and the splined shaft *a* making 5 to 1 of the spindle, gives 5 × 180 = 900 revolutions, and during which, one revolution is to be added by a regular advance, provided the spiral is right handed, and the lathe feeds from right to left. If the contrary, then one revolution is to be deducted from 900.

"On account of this increase of motion being so very slow, I have adopted a worm geared coupling on the splined shaft, as shown by Fig. 10.

"It will be seen that to secure a reduction or increase of speed between the shafts *a* and *d* of 1 in 900, the worm wheel *o* will require 45 teeth, and the ratchet wheel 20. This allows for but one motion of the pawl *e* at each revolution of the shaft *d*.

"There may be simpler ways of accomplishing this, but, in view of the conditions assumed, this appears to meet the requirements. If the increase of speed between the shafts *a* and *d* were such as to admit of a system of spur gears, as shown in Fig. 11, where the least difference between *b* and *b'* could be but one tooth, this would be in every way the most desirable.

"Referring again to Fig. 10, it has been convenient to arrange the cam *c* on the side next the worm wheel. It can be attached to either box, so as to make the advance motion correspond to the direction the spiral takes. The cut shows a short protuberance *P*, which I call a cam, on the face of the flange *P*. This should be an inclined disk, set at an angle to suit the required motion of the ratchet lever, and, of course, fixed to the box, as shown.

"In answering Problem No. 7, I think the sketches, Figs. 12, 13, 14, 15 and 16, all that are necessary. The common style shown in Fig. 12 is improved by the addition of two arms, as shown in Fig. 16. But the conditions of the Problem will not warrant this, for in this case the ratchet wheel, in order to be available in transmitting motion, must be attached to shaft on which it rests. This principle is shown in Figs. 13 and 14. It possesses the merit of durability, because of the points of the pawls always sustaining the same relation with reference to the periphery of the ratchet wheel."

The movements in Figs. 13, 14 and 15 remain to be described. In Fig. 13, *a* and *b* are each rock levers working on the shaft spindle, and each connected by a link, *d*, to the slide *e*. The latter works in a guide, *f*, which is keyed to the fixed spindle. Moving the lever *a* either to the right or the left will cause the lever *b* to move in the same direction; and if pawls be attached to these levers on opposite sides of the ratchet wheel *g*, they will act alternately to move the ratchet in the same direction through equal arcs, as required.

In Fig. 14, the two levers *b* and *c* act in the same way, except that they play on studs, *e* and *e'*, eccentric to the fixed spindle on which the ratchet works. These studs are supported by a piece, *a*, fitted and keyed to the fixed spindle. Motion is imparted from *b* to *c* by the toothed sectors *d d'*.

In Fig. 15 the pawls are carried by a slide, *b*, that plays horizontally, being supported by pins, *f*, that project into slots, *g*, in the slide. Motion of the slide in either direction is effected by motion of the lever

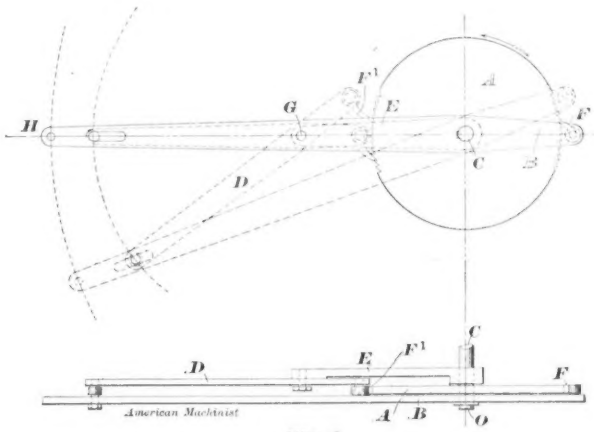


Fig. 1

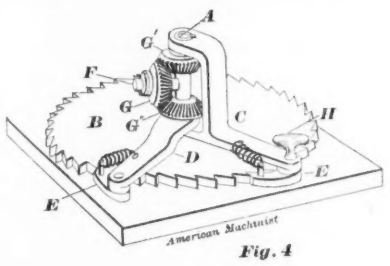


Fig. 4

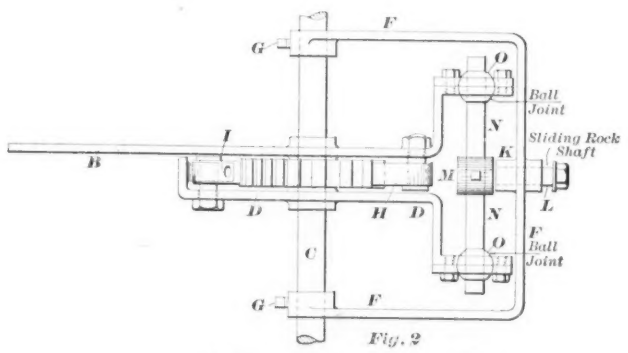


Fig. 2

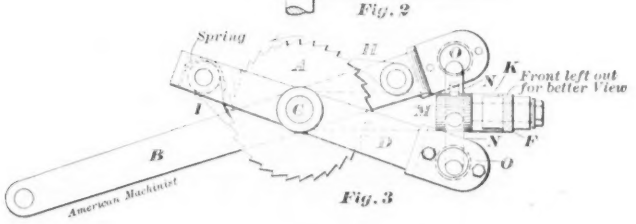


Fig. 3

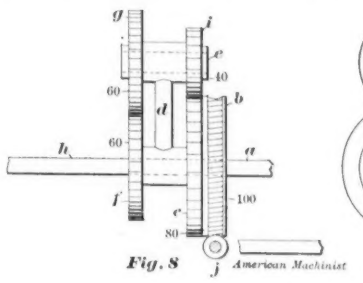


Fig. 8

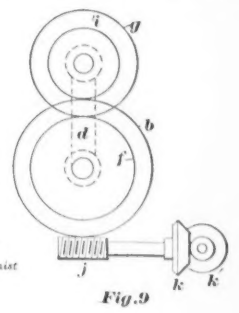


Fig. 9

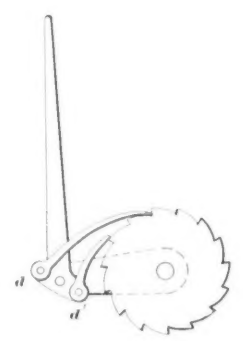


Fig. 12

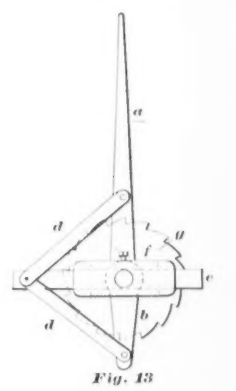


Fig. 13

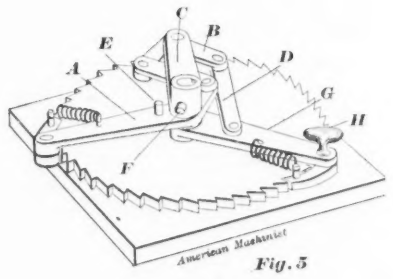


Fig. 5

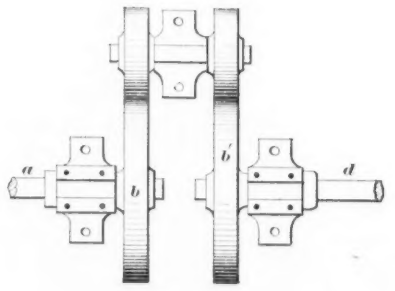


Fig. 11

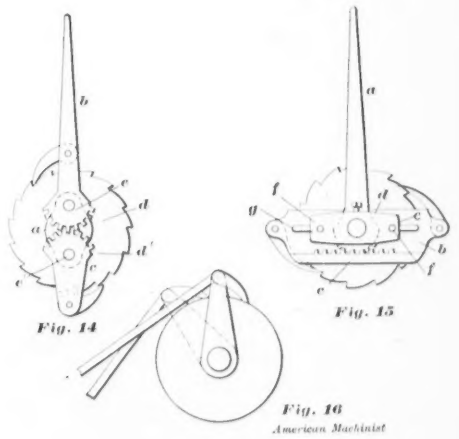


Fig. 14

Fig. 15

Fig. 16
American Machinist

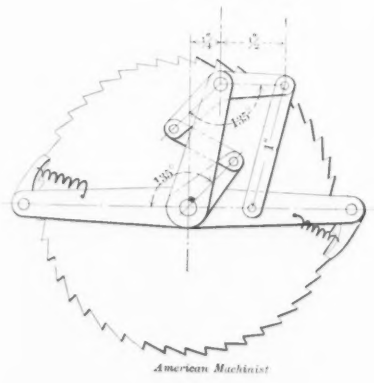


Fig. 6

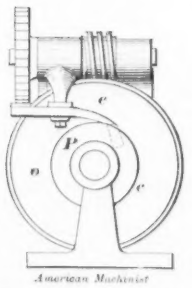


Fig. 10

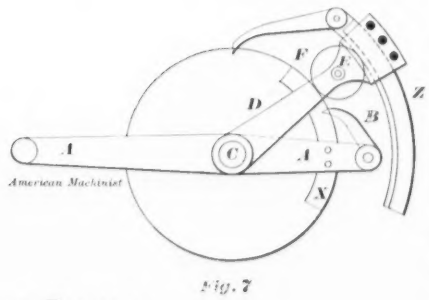


Fig. 7

ON THE CULTIVATION OF THE INVENTIVE CAPACITY BY THE SOLUTION OF CONSTRUCTIVE PROBLEMS

a in an opposite direction, through the agency of a rack, *c*, on the slide and a toothed sector on the lever *a*. In this case the center of motion of the lever *a* coincides with the center of the fixed spindle.

Here, again, unless the pawls are made long and much curved at the points, the action of the device will be limited to quite short arcs.

Some New Cycle Wrenches.

Our readers are, of course, familiar with what has been known as the Billings & Spencer (Hartford, Conn.) drop forged pocket wrench, of which so many thousands have been made and sold in connection with bicycles. This wrench is now classed as "Model A," and we present herewith engravings showing the appearance of Models B, C, D, E and F, which make a complete line of bicycle wrenches. "Model B" wrench is drop forged entirely from steel, and is finished either black or full nickel. The bar of this wrench is round on the edges, as shown, and the handle is drilled and broached for it, thus leaving it alike on both sides, and, of course, stronger than where it is cut away to make one open side.

"Model C" is the same except in the form of the handle, which, in this case, is round, hollow and knurled to give a firm hold. It is finished in the same styles as "Model B," and both these wrenches have bars graduated in $\frac{1}{32}$ of an inch.

"Model D" wrench has a drop forged steel bar and sliding jaw, and the nut, or rather, short section of screw by which the jaw is moved, can be disengaged from the notches on the bar by simply pressing on the lever on the back, and the jaw can then be moved quickly to any desired position. When the lever is released, the nut again engages automatically.

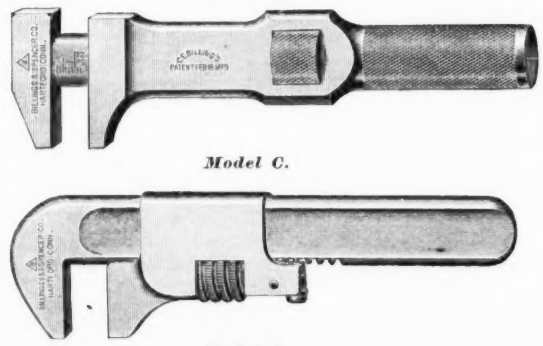
"Model E" wrench is similar to D, but has no disengaging device. Its sliding jaw may be either a forging or a steel casting, the bar being always forged steel.

"Model F" is yet another variation of style, the nut being set into a recess in the sliding jaw, which is a steel casting, the bar of this wrench being also forged.

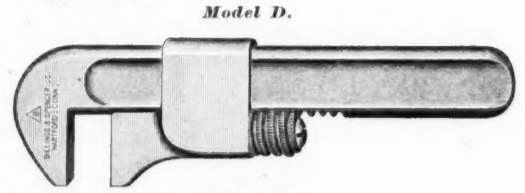
It is, of course, superfluous to say that all these are well finished wrenches, and that the forgings used in their construction are of the highest quality.

Model B.

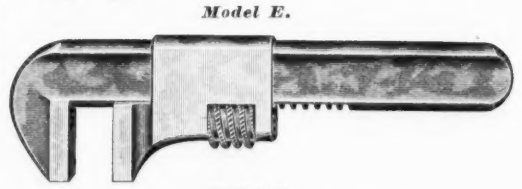
Model C.



Model D.



Model E.



Model F.

SOME NEW CYCLE WRENCHES.

Fifteenth Annual Meeting of the American Society of Mechanical Engineers.

In accordance with the programme which has been previously published in these columns, the regular fall meeting of the A. S. M. E. convened in the auditorium of the society's house, 12 West 31st street, New York, at 9 P. M., on the 3d inst; the hour or so previous to calling the meeting to order having been occupied in a very pleasant renewal of acquaintance amongst the members, and the introduction of some of them not often seen at the meetings.

The attendance was unusually large, chairs having to be brought into the auditorium to accommodate some who could find no room in the regular seats. Instead of the usual procedure of having the president's address at this juncture, the first thing done was the consideration of two topical questions; the first being, "Are there certain general principles underlying the proper connection of steam boilers and engines in a power plant?" A written (and printed) discussion of this question by Theodore F. Scheffler was first presented, which, however, was not devoted so much to a discussion of general principles as to giving details of just how, in the writer's opinion, the piping and accessories should be arranged. Mr. Scheffler takes for purposes of illustration what he considers an ideal steam power plant, consisting of four 66"x16 foot horizontal tubular boilers rated at 100 horse power each and four 13"x12" non-condensing, high-speed, automatic engines to develop 90 horse-power each. He then described how each detail of the plant would be arranged, giving sketches, and the subsequent discussion related almost entirely to his paper.

Prof. Wm. Aldrich had sent in a written discussion which was read by the secretary. Professor Aldrich's opinion was that the separator for entrained water ought to be in the horizontal pipe, and should have below a well of considerable size for holding the water, with water glasses at top and bottom, so that the engineer could at all times know just where the water stood. He thought pains should be taken to return the water to the boiler, as usually there was a very considerable quantity of it accumulating, and to blow it away was wasteful. Steam pipes leading to engines should, in his opinion, be large, and he thought that the rules for proportioning these, based on a continuous flow, as in a heating system, had too long held sway; the fact that the flow was intermittent should be taken more fully into account.

Speaking of the feed-water heater, Mr. H. H. Suplee thought they were generally of insufficient capacity, not so much because they would not heat the water sufficiently, as because their limited size caused a too rapid flow of water through them, and thus prevented the scale-forming impurities from being deposited.

This led Mr. W. R. Warner to relate the amusing experience of his concern in negotiating for a feed-water heater during the prolonged absence of their expert, and when his superintendent and himself had to go through a very considerable educating process as a basis for an intelligent selection. The heater was to be for a 100 horse-power plant, and by making comparisons of the many varieties of heaters submitted to them (not to say urged upon them) they found that the ratio of capacity existing between the smallest and the largest heater recommended was as 1 to 6, and finally an agent (he thought the twelfth one that had called upon them), and who was urging the adoption of a heater having a total capacity of only 9 gallons, was asked how he could dare to guarantee his heater to do the work. With a frankness resulting from the knowledge that he could make no sale, the agent replied: "Well, the fact is that only about one man in a hundred ever makes a test to see whether the guarantee is fulfilled or not, and they could afford to take back one heater in a hundred."

Charles E. Emery thought it was wrong to put a drain pipe in the steam pipe leading from each boiler, and place the valve in this drain pipe near the steam pipe and just above the steam dome. He said skilled engineers never handled valves so located, and trouble was apt to result from the fact that those who did handle them were comparatively unskilled men. His experience had convinced him that water could not be run through a steam pipe in a direction against the current of steam, even though the flow be very slow, and he gave a vivid illustration of the fact from his experience with some of the pipes of the New York Steam Company, in which he had thought that owing to the grade on which the pipes were laid, the fact that there were few consumers of steam, and consequently a very slow current, he could run the water back down hill against the current of steam. He found he could not do so, and had finally to put in drain pipes at intervals.

Where a number of boilers were to be connected in a single system, he advocated a check valve between each boiler and the main steam pipe, which latter he thought was the main thing to be protected so far as seeing to it that steam pressure should always be maintained in it. He gave an instance where such a check valve had been of very great service in the large boiler house of the company referred to above. A feed pump had stopped, and some headers of a boiler on the third floor were thereby broken, the fire being blown out by the escaping water and steam. But as soon as the pressure in this one boiler fell below that in the main steam pipe, the check valve closed, and so little disturbance or inconvenience resulted from the accident that it was actually not discovered until some time after it had happened; whereas, had it not been for this valve the entire system of boilers, amounting to two or three thousand horse-power, would have been blown out, for no one could possibly have gotten near the ruptured boiler to shut a valve.

He believed also that there should be a drum at the engine to catch and hold entrained water. Located there, it was under the eye of the engineer, and he would see that it properly performed its functions.

A. B. Fry referred to the fact that there were very many steam plants, especially in office buildings of cities, where ideal conditions could not possibly be attained, and that most of such plants were simply compromises between the many and various governing considerations. Especially was there usually a great lack of head room, so that it was generally difficult to get the necessary steam pipes and connections above the boilers, to say nothing of heaters so located.

The next topical question to be considered was, "What form of filing cabinet have you found most convenient for clippings, etc." This was discussed by a number of members, each of whom seemed to have his favorite method, the discussion showing that some form of the envelope system was most favored—in some cases combined with a card index. Mr F. A. Halsey said he had found the Dubois letter file very convenient for this purpose, one of its main advantages being that it could be purchased at small expense, and was then ready for immediate use without requiring any special preparation or involving much labor or expenditure of time.

W. H. Jaques said that he had over 300,000 clippings pertaining to war material filed in such a manner that any one of them could easily be found when wanted. He did not believe in pasting, and said that if a drawer were used into which clippings were first thrown promiscuously, to be properly filed afterwards, there would be trouble with it, and that the only proper way was to finally dispose of each clipping as it came to hand.

TUESDAY MORNING'S MEETING.

The society met at 10 A. M. in the annual business session. There were no reports from standing committees, except as hereafter noted, and Secretary Hutton read the annual report of the council.

The sum of $3,503.29 which had been placed in a savings bank by the treasurer, had by the council's direction been withdrawn and invested in bonds of the Mechanical Engineers Library Association bearing interest at 5 per cent. This fund has been contributed for the purpose of developing the library. Letters of thanks from the foreign engineers visiting this country last year, had been received in acknowledgment of courtesies shown them by the society.

The Society of Naval Architects and Marine Engineers, the Institute of Electrical Engineers, the American Society of Heating and Ventilating Engineers, and the New York Railroad Club, have made arrangements for holding their meetings at the house of the society.

An invitation to hold the summer meeting in Detroit had been accepted, and its date would probably be the first week in July. Since the last report ten deaths have occurred in the membership, the total in all the grades now amounting to 1,690.

The Finance Committee's report showed a very favorable condition of affairs, the total cash receipts for the fiscal year having been $29,858.53, and the disbursements for expenses $27,455.92. The actual balance of regular receipts was, however, only $59, but would have been considerably more had it not been for the extra expense caused by matters connected with the exhibition at Chicago and the Engineering Congress held there.

The tellers of election reported the following officers elected:

President, E. F. C. Davis, Richmond, Va.

Treasurer, Wm. H. Wiley, New York.

Vice-Presidents, F. H. Ball, New York; Jesse M. Smith, Detroit; M. L. Holman, St. Louis.

Managers, Jno. C. Kafer, New York; Chas. A. Bauer, Springfield, Ohio; Arthur C. Walworth, Boston.

The proposed amendments to the rules were then taken up, and owing to misunderstandings the meeting was soon involved in a parliamentary tangle, from which it seemed at times almost impossible to deliver it. Finally, however, by the unfailing good nature of President Coxe and some mutual forbearance, the machine was got running smoothly again, and the proposed amendments were adopted.

The primary cause of the irregularity was some proposed amendments by Mr. Hill, who thought there should be more classes of members—in accordance with the classifications of members in other similar societies. Mr. Hill's proposed amendments were not read to the society, but from what President Coxe said during the tangle it was apparent that one clause would require the council to sit in judgment of a member when charges were brought against him by another member.

This President Coxe was evidently decidedly opposed to, and, in fact, said that he would never sit in such judgment of a member except as a juryman in a regular court of law. Mr. Hill gave notice that he would submit his amendments for consideration at the next meeting.

The rules as they now stand permit engineers in any branch of the profession to become members and generally raise somewhat the qualifications for membership.

It was late when Mr. W. J. Keep's monograph presented as a member of the society's Committee on Uniform Methods of Testing Materials was presented. It is entitled, "Relative Tests of Cast-iron," and after touching upon the peculiar nature of the material dealt with, its differences from other metals, such as steel, etc., the effect

of different constituents is discussed, and finally an account given of the methods of casting and the results obtained with a large number of test bars, varying in size from ½ inch square to 4 inches square and of varying lengths, the object being to study and show the relation existing between Mr. Keep's proposed ½ inch square bars and all the other test bars which are, or have been, used either here or abroad. Owing to the numerous diagrams and tables which form essential parts of the paper we shall have to defer a fuller presentation of its results until a future time, and may then give the substance of the discussion upon it.

Following this was the presentation by Mr. G. M. Sinclair, of his paper, "Notes on Steel Forgings," which we printed in our last week's issue. When its presentation was complete it was 15 minutes after lunch time, and there was no discussion.

At the close of this session lists were distributed, giving the names of all the members who had registered, in the order in which they had registered, and numbered consecutively. Each member as he registered had been given a badge to which was attached the number appearing opposite his name on the register, and thus any member who wished to know or to recall the name of any other member had only to note the number borne upon his breast, and consult the printed list, and occasionally the edifying spectacle presented itself of such bosom friends as Worcester Warner and John Brashear meeting and each carefully scanning numbers and lists before venturing to recognize each other.

The plan is, however, thought to be a good one—borrowed from the practice of the American Association for the Advancement of Science. At first 300 of these numbered badges were provided, with the idea that would leave a good margin of unused ones, but by Wednesday noon 347 members had registered, and it began to be appreciated that this was considerably the largest attended meeting in the history of the society.

TUESDAY EVENING'S SESSION.

Before proceeding to the discussion of professional papers, Mr. M. N. Forney introduced a resolution authorizing the council to appoint a committee to manage a series of monthly meetings, to be held in the society's house, these meetings to be similar in character to those held last winter without official sanction by the society. Mr. Forney spoke of the reasons for and against the holding of such meetings, and Mr. Holloway, though living in New York, spoke from the standpoint of a member living at a distance, and thought such members might with some reason complain that New York members were getting more than their share of the benefits of membership.

Upon this a number of members living at a distance, not only expressed willingness that such meetings should be held, but hoped they would be, and the resolution was carried almost unanimously.

The first paper on the programme was entitled, "Trial of a Vertical Triple-expansion Condensing Pumping Engine at the Trenton Water-works," by Samuel Webber and S. S. Webber.

This engine had cylinders of 20½ inches, 36 inches, and 52"x36" stroke, and consumed 1.42 pounds of coal and 13.41 pounds of water per indicated horse-power on 112.27 steam pressure by gauge, and an account of the test was contributed to our columns by Mr. Webber, in issue of May 17, which was soon after the trial was run.

In discussing it Mr. Chas. E. Emery stated that in his opinion the cards showed that the best attainable performance had not been obtained from the engine. He thought the mean effective pressure in the third or low-pressure cylinder should have been higher than it was (6.85 pounds).

The next paper was entitled "Tests on the Triple Engine at the Mass. Inst. of Technology—Second Paper," by C. H. Peabody and E. F. Miller.

These tests were made on a 9-inch, 16-inch and 20"x30" engine, and peculiarities of the action of the jackets and reheaters noted.

It is stated that if the engine be warmed up by the jackets, and the latter then cut out, the influence of the stored heat can be measured for an hour or more after the jackets are empty, and generally the influence of the jacket was shown to be favorable.

Prof. D. S. Jacobus, in discussing the paper, called attention to the fact that, as had been shown by previous tests, jackets were considerably more beneficial on small cylinders than on large ones, and that conclusions as to the advantages or otherwise of steam jacketing should not be drawn from experiments with such a small engine, and applied to larger ones, or to those in use for driving.

At this point, Dr. Egleston having come in, his report on behalf of the committee on matters connected with gauging wire and sheet metals was called for. He reported having corresponded with a number of foreign bodies on the subject, and having conferred with a committee of the American Railway Master Mechanics' Association. The general tendency seemed to be to abandon gauges, and get down to measuring wire and sheet metals by micrometer calipers, or at least designating wire by its actual size in decimal parts of an inch. A resolution based on this practice was offered by him, and adopted, this resolution being a recommendation by the society to so measure and designate wire and sheet metals.

The next paper was "Trial of a Leavitt Pumping Engine," by F. W. Dean.

This trial was made on a pumping engine 27 21 inches and 54.13 inches by 10 feet stroke at the Louisville Water Co.'s plant, Louisville. The trial extended over 144 hours, and gave a water rate of 12.156 pounds per indicated horse-power per hour. Its discussion was deferred until the next paper, "Trials of a Recent Compound Engine, with a Cylinder Ratio of 7 to 1," by the same author, was also read. This trial gave a water consumption of 12 84 (average) pounds per indicated horse power per hour. The engine had cylinders of 18 44 inches and 48.50 inches by 48 inches stroke.

The high-pressure cylinder was completely jacketed; the low-pressure had heads so protected, with reheater in receiver. This engine was proportioned on the plan advocated by Mr. Geo. I. Rockwood, who, in discussing the two papers, gave figures to show that, had the conditions for his engine been as good as those for the Louisville engine, the advantage would have been on his side by about eight per cent., and he seemed to show pretty clearly that this comparison between a pumping engine working under generally more favorable conditions than his mill engine was working did not show that his system was inferior, but rather the reverse.

Mr. Chas. E. Emery, in discussing the paper, said that it seemed to him the two papers showed that we were not using steam at sufficiently high pressure for triple expansion engines, and that with the boiler pressures used, two-cylinder compounds could be designed to do quite as well, especially when extra cost, expense of maintenance and room were considered; and this last consideration he thought of especial importance in marine engines, and that the possibilities of two cylinder compounds in marine practice had not yet been fully developed.

Finally, Mr. Wm. Kent said that with modern conditions as to steam pressure, speed, etc., the Pawtucket pumping engine would probably do about as well as either of the engines tested.

The next paper was entitled "Changing the Suction System of a Pumping Engine," by F. W. Dean. This paper describes the manner in which a 30-inch column of water, seven miles long and coming to the pump suction under a pressure of 30 pounds, is handled without danger or difficulty, the plan adopted being a large air chamber, attached to which are six spring loaded relief valves to limit the pressure in case of any sudden surge, such as might occur in reducing the speed of the engine.

In discussion, Mr. Forrest M. Towl gave some account of the practice on oil pipe lines where oil was regularly delivered to pumps under pressures ranging from 2 to 50 pounds; and in one case a pump regularly received oil at a pressure of 375 pounds and delivered it at 900 pounds, working smoothly and well.

The last paper of the session was "Some Tests of the Strength of Spruce Columns," by Gaetano Lanza and Edward F. Miller.

These tests were made on full-sized columns of spruce of a grade such as is in common use. For timbers 7¾ inches square, 50 inches long, the ultimate strength per square inch was 3,195 pounds, and for 10-inch square columns 100 inches long, 2,613 to 2,745 pounds.

WEDNESDAY MORNING'S SESSION.

The first paper to be presented was "On the Theory of the Moment of Inertia," by C. V. Kerr.

The author protests against the ordinary definitions of moment of inertia, and endeavors to place the subject before engineers and students in a simpler manner than is usual, and amongst the practical conclusions drawn by him was that the strains brought upon the arms of engine fly-wheels by sudden throwing on or off of loads applied at the shaft were of such character as are borne by a beam fixed firmly at both ends, where one of its supports is moved in a direction at right angles to the axis of the beam, producing in the latter a double or reverse curve, and that the stress thus brought upon the arm at the hub is double what it would be if the arm were loosely connected at the rim. Owing to this fact, and to the fact that the stress caused by centrifugal force would call for practically a uniform section throughout the length of the arm, he thought they should be made so.

The next four papers, by Mr. Chas. T. Porter, were presented together by the author, and in them he describes the principal features of a new high-speed, throttling, multiple-piston-valve engine designed and built by him. The papers attracted much attention and favorable comment, and we shall probably give them further attention in a future issue.

Prof. Gaetano Lanza then presented two papers, the first being a mathematical discussion of the "Stresses in the Rims and Rim Joints of Pulleys and Fly-wheels," and the second on "The Application of Brakes to the Truck Wheels of a Locomotive."

The author gives trial data taken from experiments made on trains of the Old Colony Road. The distances run with various weights of train before coming to a stop, both with and without engine throttle closed, are tabulated.

The last paper of this session was by Prof. F. M. Goss, on "An Experimental Study of the Effect of the Counterbalance in Locomotive Drive Wheels Upon the Pressure Between Wheel and Rail."

The author made experiments on the locomotive, at Purdue University by passing annealed iron wire between the locomotive drivers and other wheels—idlers—directly under the drivers. The variations of thickness of the wire after passing through are used as a measure of the wheel pressures, and the following conclusions are drawn:

(1) Wheels balanced according to usual rules (which require all revolving parts, and from 40 per cent. to 80 per cent. of all reciprocating parts, to be balanced, the counterbalance for the reciprocating parts to be distributed equally among the several wheels connected) are not likely to leave the track through the action of the counterbalance, and cannot do so unless the speed is excessive.

(2) A wheel which, when at rest, presses upon the rail with a force of 14,000 pounds, and which carries a counterbalance 400 pounds in excess of that required for its revolving parts alone, may be expected to leave the track through the action of the counterbalance whenever its speed exceeds 310 revolutions per minute.

(3) When a wheel is lifted, through the action of its counterbalance, its rise is comparatively slow, and its descent rapid. The maximum lift occurs after the counterbalance has passed its highest point.

(4) The rocking of the engine on its springs may assist or oppose the action of the counterbalance in lifting the wheel. It therefore constitutes serious obstacles in the way of any study of the precise movement of the wheel.

(5) The contact of the moving wheel with the track is not continuous, even for those portions of the revolution where the pressure is greatest, but is a rapid succession of impacts.

The reception at Sherry's in the evening was, as usual, a brilliant and very enjoyable affair. At this gathering President Coxe delivered his address, which, as was appropriate to the occasion, was non-technical in character. He dwelt especially upon the advantage of having the ladies present at a meeting of mechanical engineers, and to the encouragement and satisfaction derived by an engineer from having his wife and possibly his daughters interested in and somewhat intelligent with respect to the work carried on by him—capable of understanding something of the reasons why his name might be known the world over, wherever industrial operations are carried on. It was very discouraging to be known everywhere except in one's own home. Suppose, for instance, Mr. Porter [Chas. T.] to go home after perfecting some of his recent work, and say, "well, my dear, we have at last got a frictionless governor," and receiving a reply something like, "well what difference does that make to you? You voted for Hill."

THURSDAY MORNING'S SESSION.

The first paper presented at this session called out the electricians of the society in force, and the air was for a time filled with voltage, amperes, potential, resistance, etc. The paper was entitled "Present and Prospective Development of Electric Tramways," by C. J. Field, and is a general comparison of old and new practice in the building of electric roads.

The running expense of the older horse lines is stated to have been between 18 to 25 cents per car mile, while with electricity the rate is given as between 1 and 1½ cents per car mile.

There was really little of the prospective element in the paper, but this deficiency was amply supplied by the discussion; several of the latest developments being sketched and described by Mr. Henning and others.

"Rustless Coatings for Iron and Steel, Galvanizing, Electro-chemical, Painting, and other Preservative Methods," by M. P. Wood, was the next paper. It is a continuation or supplement to that read before the Montreal meeting by the same author, and treats on the corrosion of boilers, fouling of ships, etc., being largely a collation of the literature of the subject.

"The Effect of Clearance on the Economy of a Small Steam Engine," by G. W. Bissell, was next. The clearance of the engine experimented upon was varied by connecting piping to the head spaces, and the most economical results were obtained with a clearance of 14½ per cent., as against 8.27 per cent.—the original condition.

Mr. F. F. Hemenway said he thought the experiments were entirely inconclusive, even for the conditions. The indicators were connected to horizontal pipes connected at each end of the cylinder and extending out at its side. Pipes one inch diameter, and of different lengths, were put on to vary the clearance space, and the indicators were tapped into this extension near the cylinder. Mr. Hemenway thought the current of steam passing across the openings to the

[*Continued on Page 9.*]

LETTERS FROM PRACTICAL MEN.

Inventors and Inventing.

Editor American Machinist:

It seems to me there never has been a time in the history of the world when a bit of slang came nearer being applicable to everybody in general than at the present time, that bit of slang being, "You have a wheel in your head."

The number of persons nowadays who have not only wheels but levers and cranks, with all sorts of notions thereof in their heads, is really surprising, and this number seems to be on the increase, too, until it has become quite a difficult matter to find a man outside of a machine shop, who is not an inventor or has not tried to be one some time in his life. This would not be so difficult to comprehend if the would-be inventors were all ignorant, unpractical people, but they are not. On the other hand, the majority of them, it seems, are rather above the average in general intelligence and common sense. It must be, however, that this intelligence does not include an adequate knowledge of physics and mechanics. Otherwise we would simply be casting reflections on their sanity.

Inventors among practical mechanics, it must be noted, are comparatively scarce, and the reason is obvious; they know what they are about and the others do not. Being practically acquainted with the characteristics and properties of the different metals, they know beforehand about what a certain sized piece of a certain metal of such or such form will do under the circumstances, and are, therefore, enabled to accept or reject it intelligently as experience and observation may dictate, and for this reason when they do invent, their inventions generally amount to something, but as a general thing, mechanics—those who some folks may think have the best chance to invent—are the most skeptical class of men in the world as regards the success of a new invention. And in most cases they have good reason to be skeptical, considering the number of inventions most machine shops—especially jobbing shops—turn out every year which prove to be absolutely worthless.

These worthless or rather absurd inventions—for even a mechanic may produce a worthless invention, as a good many have found to their sorrow—are, as I have said, almost without exception the productions of persons who know little or nothing about machinery, and I have often thought what a grotesque picture it would be if all the ideas of all these inventors could be suddenly evolved into tangible shape and placed before the vision in a panoramic view or made to pass like a circus procession, where one could get a good look at everything.

My opinion is that one would "drop dead" from sheer astonishment long before the procession had half "processed." For, undoubtedly, there would be worse things than that sail or rudder which some bright genius was going to attach to a dog's tail to enable it to turn sharp corners at right angles on a dead run—if anything worse would be needed. And this is no draft on the imagination, but, as I understand from good authority, is the substance of a patent applied for, and can be seen by the curious in the Patent Office at Washington.

And what, I wonder, in the way of absurdity could not be seen there. Statisticians say that there are about two hundred thousand models stowed away in that wonderful curiosity shop of the American people, besides numberless drawings and designs. Think of all the crystallized brain force that these things represent, the sleepless nights and weary days, the patience, energy and dollars they have cost! And these have nearly all been accumulated during the last 50 years. Of a truth, this must be the mechanical age.

But to show how ridiculous some people's mechanical ideas are: Not long ago a young fellow—a solicitor by profession, and a very shrewd one, too—asked my opinion about a scheme which had been bothering him for some time, and which he burned to see in operation. It was this: He would attach a coil spring to the treadle of a sewing machine in such a manner that when the operator moved the treadle one way the spring would pull it the other and thus save the operator half the labor. He forgot that the force required to put the spring in a position to work might be as great or greater than that required to do the work itself. Another fellow came into the shop one day in a white heat of inventive creation and asked how much it would cost to make a pair of shears to cut a scalloped edge on cloth. I told him about what they would cost and about what I thought they would be worth after they were made. The first statement scared him and the second made him angry. He *knew* they would work, etc.

But of all foolish inventing that on the line of perpetual motion seems to me the most foolish, and yet the would-be inventors of this impossibility may be counted by the dozen. They are to be found in nearly every class of society, and in age all the way from the lad of 16 up to the old gray-haired man of 60.

One of the latter class, an exceedingly mild faced, inoffensive-looking old gentleman, came to the shop one day, a year or two ago, with a bundle of drawings under his arm. What kind of a machine was it to be? Oh! he didn't know—"not much of anything." He did not have the complete machine there, but only a part of it, which he wanted us to materialize into iron and steel, after which he would invent some more to add to it. Well, he invented some more, and every few weeks brought us drawings of parts he wished made and added to the original "it." In this way

It grew
And it grew

like Mr. Finney's turnip, till there was hardly room in the shop to turn around. We soon learned that it was supposed to be a perpetual motion machine, and that its inventor not being satisfied with merely defying the law of gravitation, as most of his brethren do, had actually harnessed this force and was intending to make it do the work.

I cannot describe this device—and I don't believe the inventor himself could—further than to say that in general appearance it looked something like a gigantic endless screw or spiral gear, and consisted of parallel bars of strap iron 4 or 5 feet long fastened together in pairs with their edges 3 or 4 inches apart, between which there rolled a grooved wheel bored to receive a shaft, which in turn carried a huge spider-like wheel 8 or 10 feet in diameter. These parallel bars were so put together that each pair stood a little in advance of the other, this forming a spiral, and the grooved wheels working between them were, in some mysterious manner by the force of gravity, expected to revolve the whole thing, which was provided with gudgeon bearings on the ends.

After it had stood in the shop for about a year and a half, during which time all of us had more or less bruised our shins and cracked our ribs over it, besides being grievously tormented with answering questions as to what it was, the proud owner came and took it away.

Did it work? To be sure it worked—the money out of the old gentleman's pocket into the pocket of my employer. In this respect it worked very well indeed.

At present I hear it is making fairly good scrap iron. ANTI KNOW-ALL.

Human Nature in the Machine Shop.

Editor American Machinist:

"Much may be made of a Scotchman," said gruff old Dr. Johnson—"if he be caught young."

The same is probably true of an American. Our manufacturers certainly catch the American boys young enough, and make enough *out* of them, from a financial point of view, but what do they make *of* them?

Well, they teach them to do one kind of work, or to make one detail of a machine, and nothing else; in short, try to make machines of them.

A boy or man in such a position soon regards his work as drudgery, as a sort of necessary evil, and loses all sense of the dignity of his craft. Does it show a deep knowledge of human nature to put a man into such a state of mind?

We have, in our shop, a very eccentric grindstone. It has a "throw" of from 1½ to 3 inches; and the revolutions per minute—well, you could count 'em in 15 seconds. It's a good enough stone, but they run it too slow. As they use modern tools and methods, I can't see why they tolerate the old relic. I've hinted about that stone until my hinter is almost in need of repairs. I've spoken to toolmaker, foreman and superintendent, but all to no purpose—they take a hint from a cub—never! I wish they would speed up and true up that old stone, and provide a means of wetting it, or else go to the other extreme; increase the throw—throw it over the fence.

As I have stated before, this grindstone is the only old-fashioned tool in the shop. My employers keep the shop light and well heated and ventilated, and provide a good toolroom. They know the value of such details. But I don't think they know the value of human nature as a factor in their shop.

As for me, 25 cents a day would not greatly change the quality of my work, but it would make more than 25 cents worth of difference in the quantity. Now, I am not a machinist on account of my health, but for all that, many things besides increased wages would induce me to hustle more. I know many young men who would do more work, could they sometimes get a word of praise for a well executed job. They wouldn't always get the swell head, and would remember what the boss said long after the "raise" was forgotten.

Then again, it is humiliating to a young man to be compelled to ask for an increase of wages every time he feels it is due him.

There are several large mercantile houses to-day, who owe much of their success to the fact that every six months or year the pay roll is revised, and all deserving employes have their wages increased. If this plan pays for a mercantile house employing 500 people, why would it not pay in a manufacturing concern?

Men are like open books if looked at properly. The management of men is a thing founded upon human nature—you must know men in order to reach them.

Teachers and preachers, merchants or politicians, all make a study of human nature. Can a manufacturer afford to have less practical knowledge of human nature than they do?

A man's shop surroundings also have much to do with the amount of his work. I know that if my fellow workmen and myself could drink pure, cold water, from a clean tank, in place of the filthy beverage now provided for us; if we had a clean place to hang our hats and coats in; if we were provided with better facilities for cleaning up after our day's work, some of us would be a little more cheerful, and would not consider our work such drudgery.

There is much, very much, talk about the improvements of this age. Where are they? Has the improvement been in men, or has it been in machinery? There are too many employers "the which" think that men are made for machines. They are all wrong. *Machines are made for men;* a few of them by THE CUB.

Long-felt Wants.

Editor American Machinist:

I noticed some time ago a little item that you credit to *Industries*, which hits upon the above subject. It seems to me that in that item there are statements that are not just true. Long-felt wants are peculiar. It seems that the average person does not realize a want till he is obliged to do without something that he has in some way tried.

I have seen a blacksmith making horse-shoe nails out of stock 1½"x½", who did not realize that he was working to a disadvantage; but by a man who was accustomed to what we call conveniences, a want would be easily discovered. There have been a great many inventions that have filled long-felt wants—wants that we would shed tears over if we were obliged to want them now; but it seems that before they were filled as well as they are, there were no tears shed over them, in fact, there has been a large amount of "kicking" at every good or bad thing that seemed to be new, and I suppose that this will always be the case.

The item to which I refer stated that invention is easy, that the difficult thing is to find "long-felt wants" to supply.

Would it not sound nearer right if we put it something like this: Invention is easy if we pick out easy subjects, but if we try to fill *real* long-felt wants, we will find it not so easy, for they have remained unfilled for the simple reason that they *are* difficult. There are millions of them. They are easy to find, but hard to fill.

The item also states that it is more difficult to work out the details of an invention than it is to invent, which sounds to me like saying it is easier to start a job than to finish it.

It is safe to say that to discover a cheaper way of producing any of the recognized necessities of life is to fill to some extent long-felt wants.

Almost everything that we see around us has been worked out to a point where further improvement is difficult. If we can produce a barrel of flour at less than the present price, without cheating human labor, we will fill a long felt want.

An invention must fill a real want. Many fail in trying to create a want for an ingenious invention.

At present power costs pretty high in some places, but perhaps only a short distance away the ocean waves are wasting lots of energy at wearing away shores. If invention is so easy, here is a chance for somebody to have a very easy time.

A great many have tried to generate electricity direct from coal in an economical way. I should think such a thing would fill a want, and it does seem that it would be done if it were easy.

I should like to discover some good way of making an annealing furnace for steel, one that would be reliable with the average run of good care. Such a thing would be of great value in the world. The reason why I do not do such a thing is because I find the subject difficult, and I suppose this is the reason that others have not. The world dislikes "kickers," but it takes a "kicker" to discover "long-felt wants."

A MECHANIC.

Tool Dressing—The Racker and the Side Tool.

BY B. F. SPALDING.

The racker is a very useful turning tool. It is known in different localities under various names. It is a general utility tool. In some shops its use is confined more particularly to roughing out, but where its powers and capabilities are better known, it is also used on the finest work. The principle which it embodies as one of its elements, is that of crossing the cylindrical piece which it works upon obliquely with a straight cut, which is equivalent to using a round-nosed tool, and, if set right, leaves no feed marks.

Fig. 1 (page 7) represents the form of the racker as it is forged. It is best in making tools of this kind to cut the bar into lengths long enough for two tools, and divide them by an oblique cut across the center. Theoretically, perhaps, the tool forged on a piece of tool steel, 1¼"x⅝", should not have the blade more than 1¼" long. Practically, it is found that as these tools are generally set in the tool post, there is no loss of endurance in making them 2½" long, but in cutting the bar diagonally there is no particular advantage in making the cut more angling than will leave the tapered ends 1½" or 1¾" long, as shown in Fig. 2.

There is but little forging to do on these tools. What little there is to do is done

mainly with a round-cornered set hammer, one with a corner as rounding as quarter inch round iron—radius $\frac{1}{8}''$—is sharp enough. The tool is made narrower at the bottom to give it side clearance. There is no objection to narrowing the stock equally on both sides, rather an advantage, as the tool is sometimes used to run up to a collar, and after passing it start directly in on the other side, after the manner of a cutting-off tool, in which case side clearance is wanted on both sides. It may be thinned at the heel to $\frac{3}{8}''$, an eighth of an inch on each side, when the top face of the tool is left $\frac{5}{8}''$ wide, or the full width of the stock, and this proportion may be observed as far as practicable, if the face of the tool is made narrower.

In thinning it down, lay it on the anvil, so that the heel will just come to the near or inside corner of the anvil, tipping it sidewise at about the right pitch for the lower side, and hold the set hammer to match over it at about the right pitch for the upper side. The anvil and set hammer will then touch only the corner of the tool, as shown in Fig. 3. The hands soon become trained to set the tools in their proper positions. This is skill.

As the lower edge of the tool is thinned, hammer down the stock which has spread out, and in so doing, if a little pains are taken, a part of the top rake may be forged in, and if this is well done there will be a saving of time in grinding, which will be thankfully appreciated by the person who may have that never coveted duty to perform.

The shape of tools along about in the middle period of their usefulness, partly worn out but freshly ground, is shown in Figs. 4, 5, 6 and 7. After a tool is once put in shape at the grindstone, the re sharpening is done principally by grinding on the end. Ease of sharpening is one of this tool's chief advantages. A tool made of self-hardening steel, and worn down to the stage shown in the cuts, can be ground in one minute, and put back into good cutting shape, after running all day steadily turning $1\frac{1}{2}''$ soft steel. Seldom is more time required.

The racker has some of the good points of a diamond point. When it once gets into the kit of a lathesman it is quite apt to undermine the diamond point, and supersede it in his practice, if not in his theory. If a right-hand diamond point has a flat place ground on the nose a little wider than the pitch of the feed, and is set so that in cutting the extra width just does not scrape the cut, it does not come far from the action of the racker, as ordinarily applied to straight turning. As a matter of fact, rackers are sometimes forged in the shape of a half diamond point, shaped by grinding a bevel on the leading side, and afterwards re-sharpened by grinding off the top.

The first tools I remember to have seen which resembled the racker in the principles of its operation, were devised by Thomas Warner, formerly master armorer at the Springfield Armory, and were used for turning gun barrels. My recollection of them is that as fixed in the tool post the tool was in three parts, two of which were permanent, and one was subject to wear. These are represented in Figs. 8, 9 and 10. They were *A*, the tool support; *B*, the cutter; *C*, the cap. The cutters were strips of tool steel milled to the shape of *B*, Fig. 8. They were hardened and tempered the whole length, or as far back as it was economical to use them. They were sharpened by grinding the end. If the back end of the tool support had been shaped as shown by the dotted line, and the cutter ground on both ends, the tool would have been reversible, right or left hand, or *B* and *C* could be reversed in *A*.

The bevel of the cut, formed by grinding off the leading corner, did not extend more than half way down the long lip. It took the brunt of the work. The finish size was given by the bottom of the hollow, as it was at this place that the tool took the deepest cut. The effect of the short lip running up, was much the same as though it had run down, and continued the slope of the long lip downward. Hence the cut was equivalent to the cut made by a racker. It was necessary that the top of the hollowed part of the tool, which limited the depth of the cut, should stand at a certain height, as the work on which these tools were used was turning gun barrels, the irregular taper of which was governed by a guide, which raised or lowered the tool to make the barrel larger or smaller. Any change of the height of the tool in relation to the guide would, therefore, change the taper.

These tools were excellent for this work, for as they were sharpened by grinding off the end, their height was not altered by the grinding, and the taper of the barrel did not need any attention after the proper height of the tools was once obtained. Its accurate reproduction on successive barrels was secured by the uniformity of the tools.

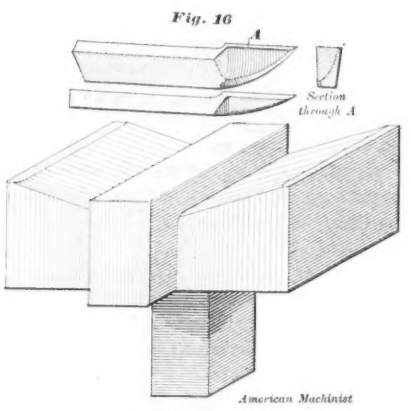
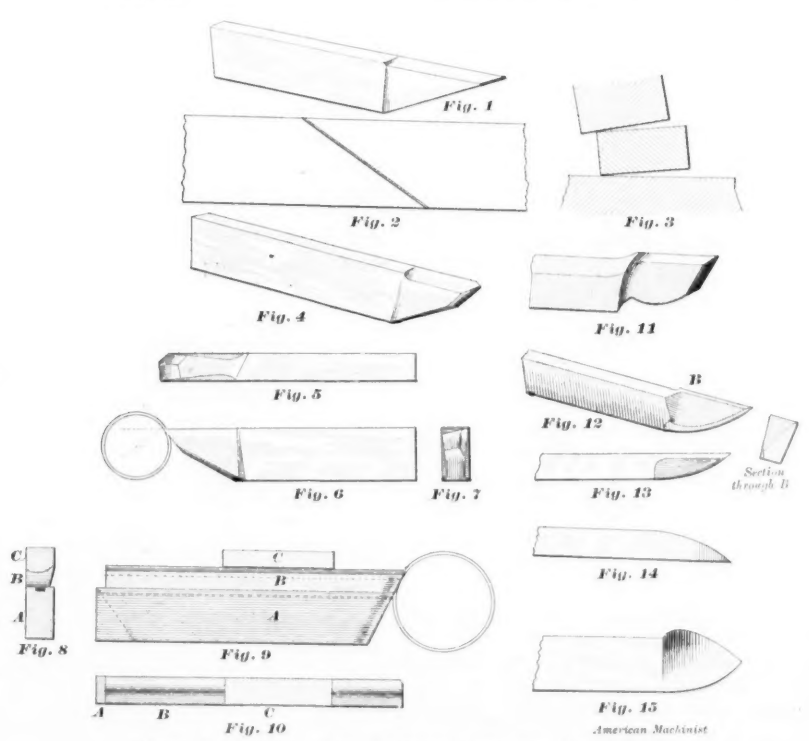


Fig. 16

Fig. 17



TOOL DRESSING—THE RACKER AND THE SIDE TOOL.

They were not as expensive in proportion to the amount of stock removed as forged tools would have been, and the claim was made for them that they would be cheaper for general use than diamond points.

Fig. 11 is copied from an illustration given by an excellent authority on lathe tools, as a representation of a side tool for "cutting down side faces where there is but little room for the tool to pass." It appears to be very well adapted for that purpose.

The ordinary long-bladed side tool, as shown in Fig. 12, is left as stout at the root as possible, because it is sometimes convenient to take a wide cut with it, which demands all the strength it can be made to possess. In forging this tool the end is drawn to a stunt point, both edge and flat ways. The side which is to be the top is kept straight.

A right-hand side tool stands, when it is cutting, at the right hand side of the work, and cuts from right to left. The left-hand side tool stands at the left hand side, and cuts from left to right. The right-hand tool is handier to forge than the left-hand tool, unless the smith is left handed, on account of the direction of the blows which must be given to thin the edge.

To make a right hand side tool when the steel has been pointed it is laid flatways on the anvil, with the heel to the left, even with the near or inside corner of the anvil, and tipped so that the heel side is raised, as the side next to the anvil is to be the right-hand side of the tool on which the bevel is to be forged. In striking it in this position the hammer must be tipped in such a manner as to keep the upper side flat, and dent the lower side, as seen in Fig. 13. Care must be taken not to dent it clear across the tool, for the side which is to be the lower side of the tool must be left as nearly the full thickness as possible. Fig. 14 shows the back left strong without indentation.

As the edge is thinned the stock spreads out, and the point is curled down, as shown in Fig. 15. When the shape becomes deformed as much as this, it is somewhat troublesome to reform it; it is best, therefore, to correct its shape edgewise before it becomes so much malformed.

In the section through *A*, Fig. 16, is shown a form of side tool which is quite prepossessing in its appearance. The blade is hollowed out, and apprentices generally think that the young toolsmith who makes side tools of this form has struck a good thing. It makes a tool that is so easy to grind, "only have to touch it to the grindstone."

There is not much in it. Its beauty is its greatest charm. It lacks the strength of the old stand-by, Fig. 12. There is one advantage which has been derived from it. This is the making of a tool to hammer the bevel of side tools on without being obliged to tip the hammer. This tool fits into the square hole in the anvil, or may be kept in a separate sow block. It is shown in Fig. 17. It should be made quite solid; fit well in the anvil also. It should be 2″ deep in the thinnest place, and 2″ wide. The extreme depth of the impression may be anywhere from $\frac{3}{8}''$ to $\frac{5}{8}''$, according to the size of tool stock which is to be worked in it. Its manner of use is apparent. The stock is laid in it to get the proper indentation, while the hammer blows are struck level.

The tongue which protrudes from the front of the anvil tool is to catch the back thrust caused by the inclination of the hot tool to slide down the bevel. If the tongue did not protrude and catch the thrust on the straight unhammered part of the tool stock, the heel of the side tool would show an indent on the back side.

When I was young I made one without the tongue, and it was shaped to make the blade concave, like Fig. 16. The concave style was a fashion that was running around wild about that time among the young toolsmiths of New England. I found that this forming tool needed improvement on account of this tendency to mutilate the heel. Some made their forming tools with the shape of the side tool impressed in them in the style of a close die, but the open tool, as shown in the cut, with the projection, gives a better opportunity to work the steel.

The older machinists did not care to have the side tools concaved. "Razors were all right that way, but side tools ought to be the other way, if any way at all, except a straight slant." They were probably right, for they broke my pretty concave side tools, and that broke my heart.

The most difficult thing to do in forging side tools is to set off the blade on the upper side to get the side rake, which, on tool steel $1\frac{1}{4}''$ wide, should be about an eighth of an inch. This can be done to the best advantage by laying the tool diagonally across the out, left-hand, corner of the anvil, the flat side of the blade down, and an eighth or a quarter of an inch more than the full length of the blade reaching over the anvil. When the tool is thus laid, its position will invite and direct the blow, which will give it the right offset.

If the anvil tool is used, the setting off for a right-hand tool is done on the side where a left-hand tool is forged. After the tool is set off, the chamfer on the lower edge is smoothed up, the lines corrected, the point cut off, and the blade straightened true with the stack.

To make a bent-off side tool the tool is forged in every way like a straight tool, except that the point is bent down, as shown in Fig. 15. In bending the tool sidewise it bends in the form due to the inside bevel surface, and when it is bent to an angle of nearly 45° the point of the tool will be found to have been raised by this process to the proper height.

A Forward Step.

Manufacturers embarking in fresh enterprises are sometimes forced to increased expense by reason of the necessity of providing in the original power plant for considerably more than the assumed normal volume of business.

If it were always possible to dispose of second-hand engines, at anything like their real value, so great a margin would not be required, as the machinery, if found inadequate, after a few years, might be sold at fair rates, and a new engine installed, but a second-hand compound of ordinary build is usually hard to get rid of at other than old iron prices—the usual possible purchasers being the smaller concerns that must look close to running expenses, and unless the engine happens to be just the size wanted (which is seldom the case) first hands are looked to who will guarantee a proper machine for the particular work to be done.

This want of adaptability to varying conditions of speed, load, etc., bars the usual build of compound from a wide field where its greater economy over the simple cylinder engine would otherwise cause its adoption, and any design tending to remove this defect is seemingly a step in the right direction.

As our readers know, we illustrated, week before last, an engine in the design of which this feature of adaptability has been considered.

Not only are both the H. P. and L. P. valves under governor control, but they are also separately adjustable. Allowing the engineer in charge to get the very best arrangement for the duty, at any time, and making the engine both more handy and more economical.

Under low powers the L. P. cut-off being shortened to the point at which H. P. drop is eliminated, the usual loss of card area per unit volume of steam may be avoided, and when overloaded the card points are also under control, in addition to the governing.

It is, of course, impossible to say at this time just to what extent this innovation may affect the general practice of engine building within the lines to which it seems adapted but it is, we think, a matter of interest and of some promise at least and its development will probably be closely watched.

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The Shamokin Boiler Explosion.

The reverberations of that boiler explosion at Shamokin have not yet died down, and the atmosphere continues filled with a fog of assumption as to the cause of the disaster.

Our transatlantic contemporaries seem agreed upon at least one point, and that is that the main responsibility rests with certain "barbarous Yankee customs," the practice of external firing being especially condemned. It seems impossible to educate the subjects of the effete civilizations to that elevated position from which alone devastation can be viewed with, at least, the outward semblance of an inward calm, which may be said to be the normal condition of the American citizen when looking upon wreck or wrong of any sort or degree.

Our English cousins, especially, seem horrified at the annihilating effects of the explosion, although it is doubtful if their feelings extend beyond the mere human element involved, and include also the suffering company which lost its boilers. The English, with their slow notions and disregard of cost, have a complicated system of inspection that is inapplicable to the conditions of a free and untrammeled people, struggling to maintain various infant industries in the face of opposing nature. They fail to realize that it would be a source of extreme sorrow and expense to many of our corporations to be forced to revise their plants for the mere sake of preventing loss of life.

Certain of our wisest statesmen, generals and lawyers who knew the wants of the country, long ago devised rules and regulations for government inspection of steam vessels, and as these have carried the country safely over the hard spots for so many years, and as they are moreover susceptible of comprehension by the humblest intellect, it is unkind to our struggling corporations to suggest that a radical revision of the ordinances should be made, and that land boilers should be subject to law, as well as those on shipboard.

Such changes would necessitate the retirement from lucrative posts of various astute politicians, and a large corps of men having experience in engineering matters would have to be created.

Such persons might raise objections to the placing of a large number of boilers in close proximity, on the ground that the theory of probabilities calls for the separation of more than a few dangerous elements, as is already done in the case of joints and seams.

Improbable as it may seem, we are not entirely indifferent to the loss of human life, but our time is limited, and incidents that might arouse others to special legislation are passed over by us as simple daily occurrences, the responsibility for which we shoulder upon Providence.

Weight and Mass.

It will be remembered that, at the Montreal meeting of the A. S. M. E., Professor Webb, in discussing shaft governors, called attention to the distinction which should be made between weight and mass in investigations of the effects produced by the various parts in motion, stating in substance that weight, so far from being wanted in the working parts of a shaft governor, was not wanted at all, but that it would be desirable to eliminate it, if possible, and leave only mass.

We are reminded of this by a curious and somewhat interesting error which is to be found in the December number of *Scribner's Magazine*, wherein Walter Launt Palmer contributes a curious tale called the "Mantle of Osiris." In this tale the author adopts the fiction of being merely the editor of a manuscript left in his hands by a friend who discovered this mantle of Osiris, and found that it possessed the property of insulating substances from the effects of gravitation; in other words, depriving them of weight. This mantle is supposed to consist of thin sheets of a peculiar metal, which, when placed under any object, prevents the earth from exercising any attractive power on that object, or at least, very little, and, as a result of its use, its discoverer says that, among other things seen by his prophetic vision, are heavy wheels with half their rims thus insulated, and therefore perpetually revolving and furnishing power by reason of the weight of the uninsulated half; and "war ships carrying their armor and monstrous guns—all weightless."

At this point, apparently to anticipate possible criticism, the author appends a footnote, in which he says that the writer of the manuscript "forgets that the weight of a gun is necessary to absorb the recoil of its discharge." Curiously enough, however, it is the foot note and not the vision that contains the error; for in the sense in which it is meant, guns do not require weight in order to absorb the recoil of their discharge. They require only mass, the effect of which is manifested by their resistance to being instantly put in backward motion by the force of the discharge; and their mass and consequently their resistance to recoil would be entirely unaffected by cutting off from them the effect of the earth's force of attraction. With a section of the "Mantle of Osiris" under it, a gun would be in much the same condition as if suspended at the center of the earth; it would have no weight, it is true, but its mass would cause it to resist being put into rapid motion, just as much as though it had weight. A little consideration of Mr. Palmer's mistake serves to make the distinction between weight and mass very clear. It is a distinction which it is important for the mechanic to have in mind, and it is too often overlooked.

Packing Goods for Export.

One great drawback to trade in certain articles between the United States and Central and South American countries, is the seeming unwillingness of many manufacturing concerns to clothe their products to suit the native fancy, and so as to withstand the very hard usage to which shipments are subjected.

At many places the vessels are forced to lie in an open roadstead, and the shipments are landed by means of barges or lighter, which are manned by a laughing, frolicking crew, acting more like school boys on a holiday than longshoremen.

Between spells of cigarette rolling and skylarking, a sling is secured to the packages, and down goes the freight helter-skelter into the boat that bumps heavily against the ship's side as she surges on the heavy swells.

The crash of glass and bursting open of boxes is the signal for shouts and laughter, the ship's officers, who may possibly be near, looking on with good-natured unconcern, experience having taught them that there is no use interfering.

Large quantities of the mineral waters and like necessaries are annually shipped from England, the citizens of such places as Salvador, Guatemala, Costa Rica, etc., paying the heavy extra freightage in preference to risking breakage most likely to result with the flimsy packing and glassware sent from the States.

A Yankee baggage-smasher would be looked upon as an impostor in any of the Central American ports touched by the Pacific Mail steamers, and until our manufacturers of perishable goods realize the true state of affairs neither reciprocity nor any other allurement will put certain Spanish-American coin in Yankee coffers.

Literary Notes.

HAND-BOOK OF PRACTICAL MECHANICS, for use in the Shop and Drafting Room. By Charles H. Saunders, Ph. B.

This is a book written and compiled for practical mechanics by a young man who has had some shop experience both before and after his course in college, and who has made a study of the things that machinists, patternmakers, draftsmen and other mechanics engaged in machinery building most often want to know. He has endeavored to make a book which tells them these things in the plainest possible manner, and to give the desired information in the most convenient form for practical application to every-day work. Such examination of the book as we have been able to make, convinces us that he has succeeded admirably. Plain, concise directions and information are given regarding angles, areas, belting, bevel gears, blue prints, bolts, cams, cone pulleys, drills; gears of all kinds, with tables, rules, etc., keys, lathe work problems, measurements, pulleys, reamers, screw threads, screw cutting, and numerous other things connected with shop and drafting room work. Many useful tables are given, some of which are entirely new; such, for instance, as a table of constants for readily finding the size at bottom of thread of any screw; a table of decimal equivalents of a pound; a table of divisions of circles into equal parts by chords; a table of taps and tapping drills, regular and special; table of tapers and corresponding angles. Where rules for calculations are given, examples are worked out; and, in the case of bevel gears, worm gearing, and in other places where necessary, diagrams are given. We notice very few errors in the book; one of these is in the definition of the vernier scale, where this scale is said to be "$\frac{11}{10}$, divided into 10 equal parts." The definition should, of course, be much broader than this, and should cover *any* number of divisions, not simply 10 and 11. Then in the directions for case-hardening, the element of time is disregarded—and time is important in case-hardening. These, however, are but minor errors, and the book as a whole is an excellent one. It is of convenient size for the pocket, and is published by the Student Publishing Co., Hartford, Conn. Price, $1

The New Science Review is the title of a new quarterly magazine, which proposes to devote its pages to the presentation of new theories and inventions or discoveries, which will be handled in a manner intended to make the magazine especially interesting and valuable to the general public, and yet maintain a high standard of scientific value. The first numbers of the journal contain matter of very great interest to those who wish to be abreast of the times in respect to what is passing through the minds of advanced investigators and thinkers in almost all branches of science. The new publication would, however, have created a more favorable impression in the minds of mechanical engineers had its first number not contained an article by Mrs. Bloomfield Moore, entitled "A Newton of the Mind," and in which article Keely is brought forward as the Newton, and the propeller of his air ship described. In our issue of September 27th, we published extracts from this article which show its character. The new magazine is published by the Transatlantic Publishing Co., 1,122 Broadway, N. Y., and 147 North Tenth street, Philadelphia.

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(560) B. H. R., Alliance, Ohio, writes: Please inform me how to plate brass and steel, or give me the name of a book treating on this subject. *A.*—You will find all these processes described in "Complete Treatise on the Electro-deposition of Metals," by Dr. George Langbein, published by Henry Carey Baird & Co., Philadelphia, Pa.

(561) E. M. S., Detroit, Mich., asks: What kind of varnish is used by manufacturers of rough malleable iron castings to prevent them from rusting. *A.*—For this purpose a cheap grade of Japan varnish thinned down with benzine to any desired degree is often used. This varnish you can obtain from any dealer in paints and oils.

(562) W. W. S., Passaic, N. J., writes: Kindly inform me what will securely fasten paper to a polished metal surface. A number of things have been tried, but the paper invariably peels off in a short time. *A.*—Dissolve rye flour in a solution of caustic soda, dilute with water, and in so doing stir well all the time. To this paste add Venetian turpentine, a few drops for each ½ pound of flour. This paste will adhere firmly to glass, tin foil and all metals.

(563) E. B., New Orleans, La., asks: Are there any books published treating on laying out boiler and sheet-iron work? If so, please give title and address of publishers. *A.*—"The Theoretical and Practical Boiler Maker," by S. Nicholls, published by the author, Blackpool, England; and the "Tinsmiths' Pattern Manual," by J. K. Little, published by the American Artisan Press, Chicago, Ill., are good books. You can obtain these from any dealer in scientific works.

(564) J. G., Westfield, Mass., writes: Some months ago I read in your paper extracts from a book giving the resistance to tension, compression, etc., of metal and other substances, and also practical tests of metals. I would be glad to know if the book has a real value, where it can be obtained, and price. *A.*—We have given extracts from several books, and, therefore, do not know to which particular book you refer. Kindly give us the date of issue, or the title of the book.

(565) G. E. L., Paterson, N. J., asks: Have you any back numbers which show how to design small boilers for steam launches? *A.*—In our issue of March 27, 1890, we have given the mode of procedure of designing small upright boilers for stationary plants, from 2 to 6 horse power. By increasing the diameter of the furnace and outside diameter of the shell a little, and reducing the height of the furnace and shell so as to bring the center of gravity as low as possible, these designs may also be used for marine purposes. We have no back numbers prior to 1893 in stock.

(566) C. A. W., Brooklyn, N. Y., writes: Kindly inform me where I can obtain in this country Reed's Engineer's Hand-book? *A.*—Reed's "Engineer's Hand book to the Local Marine Board Examination for Certificates of Competency as First and Second-class Engineers", by W. H. Thorn, is published by Thomas Reed & Co., 184 High street, West Sutherland, England. It can be obtained in this country from any dealer in technical works; probably D Van Nostrand Company, 23 Murray street, New York; or Spon & Chamberlain, 12 Cortlandt street, New York, will be the nearest to you.

(567) J. M., Toronto, Canada, writes: Have you any copies treating on theory of the planimeter? If so, can you send me a copy; and if not, can you refer me to any book treating on the subject? *A.*—In our issue of January 28, 1892, you will find the whole theory of the polar planimeter explained; but, unfortunately, we have no stock on hand, excepting bound volumes, published prior to 1893. In the catalogue published by the American Steam Gauge Company, Boston, Mass., you will find the use of this instrument explained. We cannot call to mind any other book treating on the theory of the instrument.

(568) L E. S., Sacramento, Cal., writes: Please inform me of some kind of glue or cement which can be used for fastening rubber tires on cast-iron band-saw wheels. I am at sea to know what to use to make them stick. *A.*—Dissolve gum shellac in ammonia. This is best accomplished by soaking pulverized gum shellac in 10 times its weight of strong ammonia, when a slimy mass is obtained, which in three or four weeks will become liquid without the use of hot water. This softens the rubber, and becomes, after volatilization of the ammonia, hard and impermeable to gases and fluids. The surface of the cast iron, to which the rubber is to be fastened, should be smooth.

(569) C. F. R., Newark, N. J., writes: Please let me know if the articles on "Practical Drawing" and "Modern Locomotive Construction," by J. G. A. Meyer, which appeared in your columns, have been published in book form. If so, at what price could you furnish me a copy of each? *A.*—The articles on "Practical Drawing" have not yet been published in book form, but they will be put in the publisher's hands as soon as they have been revised and the new matter which is to be added is completed. The articles on "Modern Locomotive Construction" have been published in book form by John Wiley & Sons, 53 East Tenth street, New York, from whom copies can be obtained at $10 each. We do not deal in books.

(570) C., Cincinnati, Ohio, asks: What is the difference between an injector and an inspirator? *A.*—Both work on the same principle; the difference is in the detail of construction. 2. Where is the Bethlehem Iron Works located? *A.*—In Bethlehem, Pa. 3. What is the object in making large shafts hollow? *A.*—To obtain the maximum strength with the minimum amount of metal. 4. The company for which I am working received some time ago a lot of motor bearings in halves, and they did not seem to have been soldered together. Can you inform me how they were turned and bored? *A.*—We cannot give you the information with any certainty; they may have been bored and turned in a special machine, or a lathe may have been used for the purpose.

(571) L. E. C., Wilkinsonville, Mass., writes: I wish to transmit about two horse-power from one building to another, the shafts are about 135 feet distant from each other. I intend using a 1 inch rope running on 36-inch grooved pulleys and two idlers. As the rope is exposed to the weather, I would like your advice as to the cotton or hemp rope; also what to apply for a coating on the rope. *A.*—Manila rope gives very satisfactory results. In making this rope the fibers are lubricated with plumbago, mixed with sufficient tallow to hold it in position. After running a short time the exterior of the rope gets compressed and coated with the lubricant, so that it looks, when running, like a rod of iron. In this condition it resists ordinary rains to a surprising extent, and will not need a coating. 2. Kindly give me the title and address of publishers of a plain and practical book on the care and running of a small electric light plant. I have no experience in this matter, and am at a distance from available help in case of accidents or repairs. *A.*—"Practical Management of Dynamos and Motors," by F. B Crocker and S. S. Wheeler, published by D. Van Nostrand Company, 23 Murray street, New York, is a good book.

(572) E. M. L., Brooklyn, N. Y., writes: Please state the difference in the flow of water from a tank through a hole 1 inch diameter, drilled in the bottom of the tank, and a pipe exactly 1 inch inside diameter, screwed in the bottom of the tank, the length of this pipe is 25 feet. The opening in either case is one inch diameter, the only difference being the length of pipe, which is in one case 25 feet, as stated, and in the other case it is the thickness of the bottom of the tank, say, 2 inches. *A.*—We may treat the opening in the bottom of the tank as a standard orifice; that is, an opening which is so arranged that the water in flowing from it touches only a line, as would be the case in a very thin plate. The velocity of flow in feet per second through a standard orifice is found by the following formula:

$$.98\sqrt{64.4 \times h} = v, \qquad (1)$$

in which h = head of water in feet, and v = velocity in feet per second. If, for instance, the depth of water in the tank is 10 feet, then $h = 10$ feet, and the velocity v in this case will be

$$.98\sqrt{64.4 \times 10} = v = 24.86 \text{ feet}$$

per second. Multiplying this velocity by the area in square feet of the orifice we get the discharge in cubic feet per second. The area of an orifice 1 inch diameter is .0054 of a square foot, hence the discharge per second is $24.86 \times .0054 = .134$ of a cubic foot. In computing the discharge through the pipe we shall assume that the pipe does not project inwards, but that the end is just even with the inner surface of the tank and that it stands vertical. Under these conditions the discharge will be the same as that through the orifice, but if the pipe is placed in a horizontal position, then neglecting the loss due to the bend the velocity of flow is computed by the following formula:

$$48\sqrt{\frac{h}{l} \times d} = v, \qquad (2)$$

in which h = head in feet, l = length of pipe in feet, d = diameter of pipe in feet, and v = velocity as before. If we again adopt a head of 10 feet then we have

$$48\sqrt{\frac{10}{25} \times .083} = v = 8.73 \text{ feet}$$

per second. Multiplying this by the inner area in square feet of the pipe we have $8.73 \times .0054 = .0471$ cubic feet per second for the discharge. In the above it is assumed that the pipe is of uniform section throughout and its inner surface smooth.

(573) G. M. K., St. Paul, Minn., writes: Kindly give me some information through your columns in regard the strength of a pulley of which there is a difference of opinion between the buyer and the seller. The buyer holds that it will not transmit the power which a shaft $2\frac{7}{8}$ inches in diameter can transmit, claiming that the arms are too light and the hub too short. The shaft makes 350 revolutions. The pulley is 52 inches diameter; six arms; width of arms near the hub, $3\frac{1}{16}$ inches; thickness, $1\frac{1}{4}$ inches; width of arms near the rim, $2\frac{3}{8}$ inches; thickness, $1\frac{1}{8}$ inches; length of hub, 9 inches. I can find nothing in the text-books treating on this subject, and will consider it a great favor if you will give the pulling capacity and rules for obtaining it, and the dimensions. *A.*—For finding the horse power which a line shaft will transmit, from which the power is taken at intervals bearings 8 feet apart, we may use the following formula:

$$H = \frac{D^3 \times R}{90}, \qquad (1)$$

in which H = horse-power, D = diameter of the shaft in inches, and R = number of revolutions per minute. Substituting in the above formula for the letters their values, we have

$$H = \frac{(2\frac{7}{8})^3 \times 350}{90} = 92.4,$$

which is equal to $92.4 \times 33{,}000 = 3{,}049\,200$ foot-pounds of energy exerted per minute. The circumference of the pulley is 163.363 inches, and the speed at circumference when the pulley is making 350 revolutions per minute is

$$\frac{163.363 \times 350}{12} = 4764.76 \text{ feet per minute,}$$

consequently the pull at the circumference will be

$$\frac{3\,049\,200}{4764.76} = 640 \text{ pounds (very nearly),}$$

and this is the force acting at the circumference which the arms must resist. For finding the width of arms of elliptical cross-section, Professor Unwin, in his "Elements of Machine Design," gives the following formula:

$$h = 0.1781\sqrt[3]{\frac{P \times D}{n}}, \qquad (2)$$

in which h = width in inches of arms at the hub, P = force acting at the circumference of the pulley, D = diameter of the pulley in inches, and n = number of arms. Substituting in formula (2) for the letters their values, we have

$$h = 0.1781\sqrt[3]{\frac{640 \times 52}{6}} = 3.1 \text{ inches}$$

for the width of the arms near the hub. The thickness of the arms near the hub should be $h \times .4$, which gives us $3.1 \times .4 = 1.24$ inches. The width of the arms near the rim should be $\frac{2}{3}$ of the width near the hub, which is equal to $\frac{2}{3} \times 3.1 = 2.06$ inches, and the thickness of the arms at the rim should be $\frac{2}{3}$ of the thickness near the hub, from which we obtain $\frac{2}{3} \times 1.24 = .82$ inch. These dimensions show that the arms are strong enough for the work they have to do. The hub is long enough. It may be said that, on the whole, the pulley is well designed.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Free 1895 Gear Book, see page 14.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

Milling Machs. Kempsmith Co., Milwaukee, Wis.

Turret Drills, 6 spindles. A. D. Quint, Hartford, Ct.

Forges, Foot-power Grinders, 364, Marcellus, Mich.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 157 William St., N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

Best Presses and Dies for all sheet metal work, Ferracute Machine Company, Bridgeton, N. J.

Air Compressors for every possible duty. Clayton Air Compressor Works, 26 Cortlandt street, N. Y.

Match machines for sale, splint cutters, coilers & unloaders. I. L. Hawkins, bid'r, Waterbury, Conn.

Our loose pulley oiler saves you labor, annoyance, money. Kridler Mfg. Co., Grand Rapids, Mich.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Improved Duplex and Special Gear Cutters in stock and to order; Gear and Milling Cutters of all descriptions. R. M. Clough, Tolland, Conn.

American packing rings are in touch with the cylinder. New circular about rings and pistons. J. H. Dunbar, Youngstown, O.

Emery, emery wheels, grinding machines and grinders' supplies, quick process and large stock. When in a hurry, buy of The Tanite Co., New York City, Cincinnati, Ohio, and Stroudsburg, Pa.

New Jersey Art Metal Co., Passaic, N. J., finest thin and ornamental castings in brass, bronze, aluminum, etc.; machinery name plates in brass and aluminum.

"Hand-book of Practical Mechanics" for dfsmen, mach's & tool makers will be mailed on receipt of price, $1 for cloth cover, $1.25 for leather cover. Chas. H. Saunders, P. O. Box 963, Hartford, Conn.

"Binders" for the AMERICAN MACHINIST. Two styles, the "Common Sense," as heretofore sold by us and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 post paid. Published by John Wiley & Sons, 53 East Tenth street, New York.

"Modern Locomotive Construction." By J. G. A. Meyer. In this book the design and construction of all details of the locomotive and tender are considered from a practical standpoint. It contains illustrations of details made from working drawings, accompanied by plain directions for designing, and rules and tables for construction. Adapted to office and shop use. Price, $10. Published by John Wiley & Sons, 53 East Tenth street, New York.

Fifteenth Annual Meeting of the American Society of Mechanical Engineers.

[*Continued from Page 5.*]

indicators would, by setting up induced currents, utterly vitiate the records, in which opinion he was sustained by Prof Jno. E. Sweet, who was in the chair at this session.

Mr. Kent objected to the inclusion in the paper of the complete log of the tests. He thought it was useless, and only tended to needlessly increase the bulk of the published transactions. The author of the paper was not present. The engine experimented upon had a cylinder 4½ inches by 9 inches.

The next paper was "Results of Measurements to Test the Accuracy of Small Throttling Calorimeters," by Prof. D. S. Jacobus.

These tests indicate glaring errors in the ordinary calorimeter results. The amount of moisture by what the author of the paper assumes as a reliable method of determination, being but about 50 per cent. of that shown by the usual instrument and methods. The general conclusion seemed to be that the main difficulty was in getting from the steam pipe a fair average sample of the steam passing through it, and he had obtained the dryest steam when the opening from which he took his sample faced the current in the pipe.

There was no regular assignment for Thursday afternoon, but by general agreement a meeting was held in which a number of members, starting out to discuss Mr. Keep's paper, really discussed a large range of foundry practice, the supposed rival claims of the "practical men" and the "theoretical men" being prominently brought forward.

Mr. Robert Cartwright, representing the former class especially, said it was much more difficult to get a competent foundry foreman than a competent machine shop or smith shop foreman, and that when one was secured he was usually a Scotchman. The most successful men in making castings—which was what foundries were operated for—usually knew nothing about silicon, manganese, etc., but knew how to make molds and how to pour the iron into them. It was a matter of individual skill, practice and, perhaps, intuition.

Jno. Fritz, Thos. D. West, J. F Holloway and others gave results of their experience, but lack of space forbids our giving a further account of the discussion at this time, though we may be able to do so in a near issue.

FRIDAY MORNING'S SESSION.

The first paper to be presented at this session was that of Prof. Jno. H. Barr, entitled "Experiments on a System of Governing by Compression."

In this paper the author gives experimental results of virtually *shifting* the card area in the cylinder by fixing a cut-off later than due to load, and reducing card area by excessive cushion alone. The difference in economy between this method and that ordinarily pursued, was practically *nil* in the engine used, though slightly in favor of the compression method.

Prof. D. S. Jacobus, in discussing the paper, called attention to the fact that, though the indicated horse-power was about the same by the two methods, the net horse-power was considerably greater when the steam distribution was by the ordinary method, the falling off in net efficiency being due evidently to the excessive friction caused by the compression, this being, in

fact, about twice as great when governing by compression.

In reply to this, Professor Barr said the engine experimented upon was too slow speed to bring out the possibilities of the system, and he thought it would do much better in respect to friction and net horsepower if high speed. In connection with this, he mentioned some experiments carried on at Cornell University to determine the temperature of the cylinder walls, of which we shall give some account later.

The next paper was that of Jos. C. Platt, and was entitled "Straightening a Leaning Chimney 100 Feet High."

The detailed operations of bringing a large chimney "plumb" are here given, and a table of measurements showing the rate of righting is appended.

The chimney is a square brick one, standing near a river, and by unequal settlement of the supporting earth it was thrown out of plumb 28½ inches. It was brought back by excavating down to the bottom of the foundation opposite to the direction in which it leaned, and then boring holes in the earth still deeper by means of post hole augers. As the augers were withdrawn from the holes they had made, the holes closed in by the pressure of the surrounding earth, and the chimney was in a short time brought back to the perpendicular. Cables were attached to the chimney at a height of 42 feet above the stonework, and these were strained by a system of pulleys, or slacked off as occasion required during the operation.

The next paper was by A. Wells Robinson, and describes a drawing-board easel for holding drawings for reference, and a blue print frame; all of simple construction.

In discussion, Mr. Woodbury described a method of copying or tracing drawings where it was desired to have the tracing on regular drawing paper instead of on tracing paper as usual. The method was to put the drawing to be traced on a large piece of plate glass right side up, and place over it the paper to be worked on. Under the glass was placed an ordinary incandescent lamp bracket, with the lamp and shade turned upside down, so as to illumine the drawing from the bottom through the glass. In this way the work was as easily done as though tracings were made in the ordinary way. Another member had done a similar thing, but had used only a small piece of glass set into the upper surface of a drawing-board at the middle, as he had wanted only to reproduce some small sketches.

The next paper, that of Prof. L. S. Randolph, discussed the "Strength of Railway Car Axles."

The effects of repeated stress are discussed, the general conclusion being that there is need for more experiments on the action of alternating flexure.

The paper speaks of the strain imposed on axles by the springs being occasionally brought down solid, and a member referring to this said that he had made experiments in which he had loaded a car at one end with pig-iron until the springs at that end were deflected to two-thirds their possible deflection, and then run the wheels over wedges, letting them drop 3 inches onto the track, pellets of putty placed under them showing that the springs were not brought down solid.

Mr. Durfee described a car axle with a curved instead of a parallel journal. This axle he said had been tried on one of the roads, and had been found to possess certain marked advantages. Another member said that in the present condition of railroading and interchange of cars such a variation in the form of axle was practically impossible to be adopted by any one road. Each road must use what the other roads were using.

E. D. Estrada said that according to some of the values given in the paper, axles running under some conditions of service would have to be renewed every day. Asked how long an axle should remain in service, he said he did not know. It depended entirely upon the nature of the surface, and the character of the track over which it ran. For instance, when a road was in the hands of a receiver, axles would last longer, because the tracks were better kept up.

L. R. Pomeroy said that steel axles were now much stronger than when the experiments referred to in the paper were made, and that they were now being regularly furnished with an ultimate strength of 92,000 to 95,000 pounds per square inch.

The next paper was "A Graphical Method of Designing Springs," by G. R. Henderson. In this paper diagrams are given, by means of which the strength and deflection of helical and elliptical springs can be very readily found. Actual tests and the comparisons of the data with that taken from diagrams are included in the paper, and show a close agreement.

Mr. Wm. Kent, in discussing the paper, said that the table for springs used by the Pennsylvania Railroad, and a table forming part of an article by J. Begtrup, published in the AMERICAN MACHINIST, agreed closely and he especially commended the later as being convenient and reliable. Rankine and Clarke did not agree with these, and he believed were not right.

The last paper was that of David L. Barnes, on "Rail Pressures of Locomotive Driving Wheels." This is a long paper with numerous diagrams, representing evidently a great deal of highly skilled work. The author's conclusions were that:

(*a*) The present method of counterbalancing locomotives by providing in each driver a balance sufficient to fully counterbalance all the revolving parts, and an additional balance, known as the "excess balance," which has a centrifugal force equal to about two thirds of the maximum inertia of the reciprocating parts, is practically perfect so far as the locomotive itself is concerned.

(*b*) The "excess balance" now generally used for the reciprocating parts and counteracting about two-thirds of the maximum inertia of those parts, is too great for speeds above 65 miles an hour, with drivers less than six feet in diameter, as the track is liable to be damaged by the excessive rail pressure that it causes.

(*c*) The only practical way in which the "excess balance" can be reduced is by reducing the weight of the reciprocating parts, and as these parts are generally made heavier than the service demands, it is possible to reduce the "excess balance" to a point where the rail pressures will not be destructive, provided that the diameter of the drivers be made suitable for the speed.

(*d*) The larger the driver for the same speed and weight of reciprocating parts, the less will be the maximum rail pressure caused by the "excess balance."

(*e*) The heavier the locomotive, the greater is the amount in pounds of the reciprocating parts that can remain unbalanced without causing the locomotive to shake, in "nosing" and "plunging" more than can be permitted. It is not the *percentage* of the total weight of the reciprocating parts that should be considered in selecting the "excess balance;" it is the actual weight in pounds that can remain unbalanced without shaking the engine too much. If one-third of the weight of reciprocating parts weighing 600 pounds can remain unbalanced, then, if those parts be reduced to weigh but 400 pounds, one half can remain unbalanced, and "excess balance" will be needed for but 200 pounds instead of 400 pounds of reciprocating weight.

(*f*) The maximum rail pressure of a driving wheel is not at all indicated by the static load of the wheel on the rail. The impressed load due to the "excess balance" is often double the static load, and the pressure at the point of impact when the wheel lifts from the rail and drops is even greater. There appears to be no way of determining what the impact pressure is, but the impressed load due to the "excess balance" can be calculated by the formula for centrifugal force. About all that is known about the impact pressure is that it is enough at times to bend a 70 pound rail downward vertically one inch, in cases where the engine has small wheels and is run too fast, or has the rods taken off and is run at moderately high speeds, or has improper counterbalances.

(*g*) The speed at which any given driver will begin to lift from the rail is probably less than that at which the centrifugal force of the counterbalance equals the pressure of the wheel upon the rail, as at speeds lower than that the wheel has small vertical oscillations that may carry it off the rail. But the lift will not be important until the speed has increased to a point where the centrifugal force of the "excess balance" is somewhat greater than the pressure of the wheel on the rail.

(*h*) The exact height of lift of a wheel in any given case is dependent upon so many unknown and variable quantities in practice, such as the flexibility of the track and the rhythm with which points of equal flexibility succeed each other in the direction in which the locomotive is running, that it is impossible to predict what it will be. But it is sufficient to know that for the good of the track, and to prevent broken and bent rails, and for the safety of a train following a locomotive it is not prudent to run a driving wheel at a speed where the centrifugal force of the "excess balance" exceeds the pressure of the wheel upon the rail.

(*i*) All driving wheels for fast locomotives should be as large in diameter as it is possible to make them and not decrease the power too much in starting trains.

(*k*) The path of the center of gravity of a wheel, with respect to the engine during a revolution, is an oval figure with the long axis more nearly vertical than horizontal, the inclination of the axis varying constantly, owing to the difference in the elasticity of the track at different points, and to other causes.

(*l*) The heavier the driving wheel and the parts under the driving springs, and the stiffer the driving springs, the less will be the lift from the rail, all other conditions being equal.

Geo. S. Morison objected to some of these conclusions, and stated that Geo. S. Strong had designed a locomotive in which the revolving parts were balanced by revolving parts, and the reciprocating parts by reciprocating parts. He believed this locomotive overcame many of the objections mentioned in the paper, and removed some of the limitations of the present ordinary construction. Mr. Strong, being called upon to do so, gave some account of his engine, and drew a sketch of its general plan. It is a four cylinder compound with the two high-pressure cylinders inside the frame, and connected to the axle which is cranked and of nickel steel, oil tempered, 9 inches diameter. These cranks are placed 90 degrees from each other, and are as close to the wheels as possible. Outside are the two low-pressure cylinders, which are 24 inches diameter, and these are connected in the ordinary way, each crank pin being 180 degrees from the inside crank nearest to it. The outside pistons are of pressed plate steel $\frac{5}{16}$ inch thick, with a cast ring riveted into them to hold the packing rings, and the piston rods are hollow. The inside pistons, which are 17 inches diameter, are not lightly constructed, the reciprocating parts for these being, in fact, of the same weight as for the larger low pressure cylinders. The result of this arrangement is that the reciprocating parts balance each other, while those rotating parts that are out of balance, are counterbalanced separately by equal weights placed at the same distance from the center of rotation. No reducing valve was used because the high-pressure cylinders were able to slip the driving wheels in starting, and the engine was to be always used compound.

After this, in discussing one of the topical questions, C. J. H. Woodbury exhibited a special form of Bell telephone especially designed for use in factories, and M. P. Wood showed a material called calcium carbite, which, when placed in cold water, formed a gas which burned freely upon being ignited. The substance is composed in the main of finely divided coal and lime, calcined in an electric furnace. By the use of this he said that a perfect system for domestic lighting was possible at relatively little expense and that the gas burned well with an admixture of 40 per cent. of air, which was not explosive. It had been produced at a cost which corresponded to $1.50 per 1,000 for ordinary city gas, and it was expected to reduce this to $0.75 and even considerably lower.

Below we give a list of those who registered up to Thursday at 1 P. M.

1 Hutton, F. R., Secy.
2 Hoadley, F. W., Sec'y's Repr.
3 Whitier, Chas.
4 Keep, Wm J.
5 Webster, J. H
6 West Thos. D.
7 Gregory, Wm.
8 Stewart, R. T.
9 Lane, H. M.
10 Rankin, Thos. L.
11 Brashear, J. A.
12 Muller, T. H.
13 Brady, Jas.
14 Henderson, Alex.
15 Hale, R. S.
16 Hale, G. S.
17 Wood, M. P.
18 Cheney, W. L.
19 Varney, W. W.
20 Partridge, W. E.
21 Hillard, C. J.
22 Cullingworth, C. R.
23 Cary, A. A.
24 Butcher, J. J.
25 Peek, G. M.
26 Bang, H. A.
27 Hart, C. E.
28 Gordon, Alex.
29 Estrada, E. D.
30 Penney, Edgar
31 Hough, D. L
32 Griffen, E. C.
33 Walker, J.
34 Fry, A. B.
36 Billings, C. E.
37 Wiley, Wm. H.
38 Pickering, T. R
39 Hunt, C. W.
40 Chase, W. L.
41 Weeks, G. W.
42 Platt, John.
43 Cadwell, W. D.
44 Bullock, E. R.
45 Davis, E. F. C.
46 Morse, C. M.
47 Christie, W. W.
48 Baldwin, F. L
49 Greensmith, Jas E.
50 Meatz, J. T.
51 Sargent, J. W.
52 Henning, G. C.
53 Carpenter, H. A.
54 Durfee, W. A.
55 Holloway, J. F.
56 Woolsen, O. C.
57 Chase, H. S.
58 Stiles, N. C.
59 Huston, C. L.
60 Varmen, I.
61 Gilkerson, J. A.
62 Hoppes, J. J.
63 Melvin, D. N.
64 Van Derhoet, G. N.
65 Hand, S. A.
66 Guilford, W. M.
67 Moore, M. F.
68 Moore, A. B.
69 Ross, E. L.
70 Hunting, A. A.
71 Hemenway, F. F.
72 Cartwright, Robert
73 Baldwin, F. R.
74 Moore, D. G.
75 Calwell, A. W.
76 Strong, G. S.
77 Fritz, John
78 Smith, H. W.
79 Idell, F. E.
80 Pomeroy, L. R.
81 Connell, J. A.
82 Baldwin, S. W.
83 McMannis, Wm.
84 Norris, H. M.
85 Clark, S. J.
86 Hunt, Wm. F.
87 Yereance, W. B.
88 Bauer, Chas. A.
89 Miller, F. J.
90 Jenkins, W. C.
91 Souther, H.
92 Monaghan, W. F.
93 Marx, Henry
94 Doane, W. H.
95 Winship, J. G.
96 Newcomb, Chas. L.
97 Green, S. M.
98 Langlotz, Chas.
99 Halsey, F. A.
100 Ferney, M. N.
101 Stangland, B. F.
102 Webster, Wm. R.
103 Torrey, H. G.
104 Stearnes, Albert
105 Hopton, W. E.
106 Frevert, H. F.
107 Glenn, H. F.
108 Cruikshank, Barton
109 Nicoll, Chas. H.
110 Curtis, R. E.
111 Emery, Chas E.
112 Sewell, M. W.
113 Flagg, S. G., Jr.
114 Bond, Geo. M.
115 Hamilton, J. V.
116 Coxe, Eckley B.
117 Wright, L. S.
118 Parsons, H. de B.
119 Smith, Oberlin
120 Warner, W. R.
121 Langlotz, Robert
122 Suplee, H. H.
123 Norris, John H.
124 Conover, E. K.
125 Mayo, J. B.
126 Bradley, W. H.
127 Montgomery, H. M.
128 Warren, S. H.
129 Kent, Wm.
130 Clark, T. C.
131 Lyall, W. L.
132 Richmond, Geo.
133 Mills, E. L
134 Ryan, R. H., Official Steno.
135 Jacques, W. H.
136 Colvin, F. H.
137 Goetz, V. J.
138 Zehnder, C. H.
139 Richards, Frank
140 Mumford, E. H.
141 Caldwell, A. J.
142 Meyer, H. C.
143 Dinkle, G. D.
144 Meyer, H. C., Jr.
145 Creelman, Frank,
146 Dale, O. G.
147 Hutchinson, C. T.
148 Jacobus, D. S.
149 Sinclair, Angus
150 Clark, Walton
151 Sague, J. E.
152 Rowland, C. B.
153 Fladd, F. C.
154 York, H. W.
155 Frith, A. J.
156 Binsee, Henry
157 Rowland Thos. F., Jr.
158 Lieb, J. W., Jr.
159 Taylor, J. T.
160 Rusby, J. M.
161 Horstman, H. J.
162 Mosher, C. D.
163 Lockwood, J. F.
164 Woodbury, C. J. H.
165 Wilcox, J. F.
166 Platt, John C.
167 Fowler, G. L.
168 Pentz, A. D.
169 Pentz, A. D., Jr.
170 Messenger, F. M.
171 Richards, F. H.
172 Morrison, G. S.
173 Flather, F. B.
174 Matlack, J. R.
175 Corbin, D. R.
176 Anthony, G. C.
177 Towne, Henry R.
178 Huson, W. S.
179 Schutte, L.
180 Darling, E. A.
181 Thomson, John
182 Morgan, Chas. H.
183 Morgan, Paul B.
184 Wiggin, W. H.
185 Kerr, C. V.
186 Gale H. B.
187 Engle, L. G.
188 Whitehead, Geo E.
189 Payne, S. F.
190 Matlack, D. J.
191 Miller, L. B.
192 Porter, Chas. T.
193 Whitney, B. D.
194 Hawkins, W. C.
195 Jacobi, A. W.
196 Porter, Wm.
197 Low, F. R.
198 Magoun, H. A.
199 Pike, Wm. A.
200 Gaskin, Ed.
201 Taber, Harris
202 Seavey, J. F.
203 Seymour, J. A.
204 Buzby, C. E.
205 Tolman, Jas. T.
206 Knight, A. F.
207 Bourne, S. N.
208 Pollock, James
209 Barr, John H.
210 Batchelor, Chas.
211 Simonds, E. A.
212 Almy, Darwin
213 Sinclair, Geo. M.
214 Ackerman, W. S.
215 Hill, Geo.
216 Ward, W. E.
217 Gantt, H. L.
218 Lane, J. S.
219 Snell, H. S.
220 Platt, Geo. H.
221 Stearns, G. L.
222 Snell, F. I.
223 Towle, F. M.
224 De Schweinitz, P. B
225 Cremer, James M.
226 McElroy, S.
227 Wiley, W. O.
228 Boenig, R. W.
229 Allen, J. H.
230 Stilman, H.
231 Norris, R. Van.
232 Aimond, Thos. R.
233 Sheffler, Fred. A.
234 Barrus, Geo. H.
235 Stillman, F. H.
236 Waldron, Fred. A.
237 Longnecker, C. K.
238 McKee, J. J.
239 Larkin, F. A.
240 Gould, W. V.
241 Hayward, F. H.
242 Thomas, E. G.
243 Gobeille, J. L.
244 Schnell, Julian
245 Beach, Giles
246 Bulkley, H. W.
247 Roelker, H. B.
248 Spies, Albert
249 Baker, Chas. W.
250 Ridgway, J. T.
251 Smith, Chas. F.
252 Jones, Washington
253 Skinner, Frank W.
254 Mitchell, B. M.
255 Piers, Frank
258 Gill, John L., Jr.
259 Wood, De Volson
260 Dunham, H. F.
261 Rockwood, Geo. I.
262 Wright, J. Q.
263 Wellman, C. A.
266 Bang, A. C.
267 Bang, F. W.
268 Dashiel, W. W.
269 Haskins, H. S.
270 Miller, H. B.
271 Klein, J. S.
272 Painter, Wm.
273 Beardsley, A.
274 Harttess, Jas.
275 Robinson, J. M.
276 Barr, H. P.
277 Fogarty, Jno.
278 Cobb, Geo. H.
279 Pilkington, Jno.
280 Grimm, Paul H.
281 Redwood, I. I.
282 Owen, Jas
283 Messenger, C.
284 Burr, S. D. V.
285 Hildreth, P. T.
286 Cole, F. J.
287 Rowland, Thos. F.
288 Webb, J. B.
289 Ingersoll, W.

290 Stevens, E. A.
291 Lockwood, E. H.
292 Marble, H. M.
293 Wolff, A. R.
294 Olmsted, Edwd.
295 Almirall, J. A.
296 Foster, E. H.
297 Tayler, Wm. M.
298 Davis, D. K.
299 Jones, F. C.
300 Kruesi, John
301 Forbes, W. D.
302 Camp, Geo E.
303 Wheeler, S. S.
304 Webber, Wm. O.
305 Greenwood, P. F.
306 Egleston, Thos.
307 Farrand, Dudley
308 Barnes, A. T.
309 Mason, Wm B.
310 Sweet, John E.
311 Rowland, Geo.
312 Bradley, Chas. L
313 Laforge, F. A.
314 Logan, Jno. W.
315 Daniels, F. H.
316 Wyman, H. W.
317 Hawkins, J. T.
318 White, Maunsel
319 Edwards, L. T.
320 Nason, C. W.
321 Stanley, A. W.
322 Walworth, A. C.
323 McGeorge, John
324 Hyde, C. E.
325 Sahlin, A.
326 Pitkin, S. H.
327 Goubers, A. A.
328 Bole, Wm. A.
329 Rowland, A. E.
330 Moulthroup, L.
331 Jenks, Wm A.
332 Deane, C. B.
333 Newhall, J. B.
334 Naylor, E. W.
335 Cogswell, W. B.
336 Cramp, E. S.
337 Aller, A.
338 Kerr, W. C.
339 Webber, S. S.
340 Lager, Carl
341 Stockley, G. W.
342 Chandler, A. D.
343 Schwanhausser, Wm.
344 Canfield, H.
345 Todd, G. L.
346 Baker, M. N.
347 Keith, N W.
348 Smith, G. W.
349 Picton, Edmund
350 Phillips, Franklin
351 Smith, A. P.
352 Field, B. K.
353 Tucker, Wm. B.
354 Upson, L. A.
355 Wheelock, J.
356 Ashley, F. M.
357 Ware, J. A.
358 Thomas, E. W.
359 Johnson, A. E.
360 Davis, R. B.
362 Childs, A. E.
363 Campbell, Gordon
364 Dobbins, S.
365 White, H. C.
366 Bristol, W. H.
367 Graves, Erwin
368 Wheeler, Seth
369 Freeman, John R.
370 Roberts, Wm.
371 Knickerbacker, John
372 Nelson, Geo. A.
373 Boyer, F. H.
374 Kaven, M. B.
375 Manning, Chas. H., U. S. N.
376 Ludlow, Wm. O.
377 Lesser, A.
378 Breen, G. E.
379 Breen, A. E.
380 Rettew, C. E.
381 Treat, C. H.
382 du Faur, A. F.
384 Auchincloss, W.
385 Gwilliam, Geo.
386 Tildon, J. A.
387 Field, C. R.
388 Dripps, W. A.
389 Hershey, M. E.
390 Fleming, W R.
391 Quimby, W. E.
392 Conrad, H. V.
393 Morris, H. G.
394 Barnum, Geo. S.
395 Eaton, L. B.

Not quite all of these are members though most of them are, and the total registration was 426—by far the largest attended meeting ever held in New York.

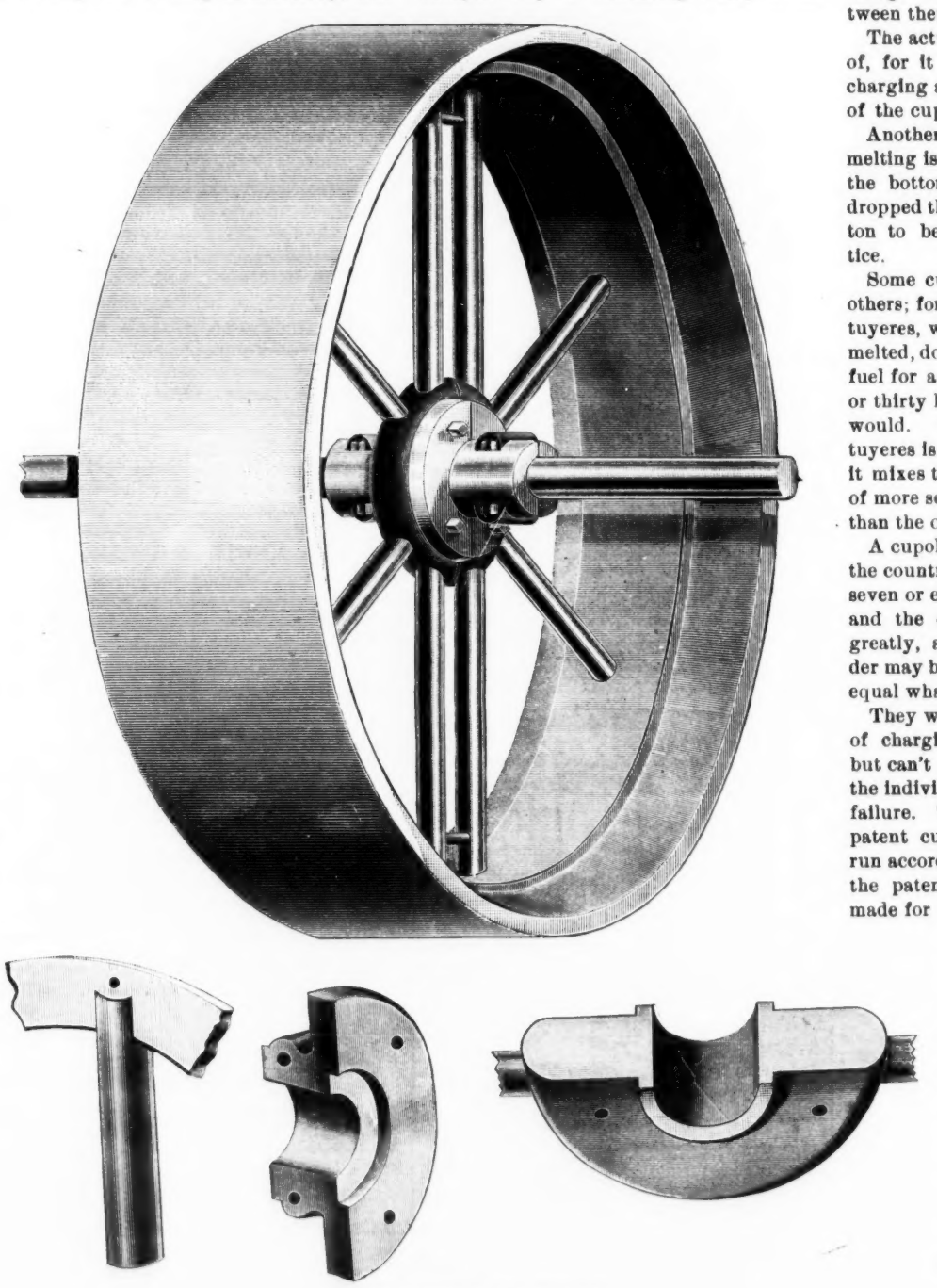
The Dryden Split Pulley.

The accompanying cut illustrates the general construction of a new split pulley, placed upon the market by Messrs. Woodruff & McCabe, of Winsted, Conn.

The hub, which is made detachable, admitting of adjustment to various sizes of shaft, grips the latter in such a manner as to afford a positive hold, and being entirely of metal, there is no annoyance, such as is likely to be the case where wooden bushings are used.

The tubular iron spokes admit of great strength with light weight, and the wooden face allows of the greatest amount of power transmission with the least tension of belt.

The pulley is made in all sizes, from 9 inches diameter and 3 inches face, to 120 inches diameter and 18 inches face.



THE DRYDEN SPLIT PULLEY.

Economy in Melting.

BY HERBERT M. RAMP.

In this article I shall endeavor to explain part of the reasons why there is such a diversity of opinion as to the true economy of melting iron, and such variable records from different men and localities.

Economical melting is an end all foundrymen are grasping for, but what each individual regards as economy is a different matter, and circumstances often render it impossible to accomplish the same results in all places. One will say: "Let me melt with the least possible amount of fuel; that is economy. Time consumed or blast pressure used make no difference in expense, neither do they increase or decrease my output, but actual saving in pounds of fuel represents so many dollars." Such is the case when the shop is far removed from the localities where coke is made, and shipping makes it expensive, or where the cupola capacity is larger than necessary for the work it has to do, and rapid melting is not a necessity.

Another will say: "Rapid melting is what I desire; a few hundred pounds of fuel is no object. The quickest time I can make in running off my heats is dollars to me. Delay means decreased production, time cut off my molders, or an extra assessment in the direction of overtime paid to men for staying late." The foregoing is true of shops where cupola capacity is small and heats large, and numberless times have I observed men sitting around or doing little, but simply waiting for iron.

Not a cent was ever made in saving fuel at the cost of a decreased production, no matter if coke was expensive.

Again, one will observe: "My blower is small and I have not engine or boiler power to drive it as rapidly as necessary. Show me how I can melt cheap and use low blast pressure; fuel or time count for little if I melt successfully with the fixtures I now have. Cannot afford a new boiler, engine and blower."

Still, again, the cry will come: "If I can run my cupola with a reasonable amount of fuel and make fair time, 'twould be satisfactory, but it wears out the lining so rapidly, 'tis a constant source of delay and expense to re-line so often."

Complaints of cupolas bridging over, and bunging up in the middle of the heat, not being able to slag satisfactorily, making dull iron, and a hundred other complaints, show the barriers to economy that each individual encounters. All these things come up every day, and in each particular instance the individual idea of economy is true, so far as that individual is concerned.

The stove molder does not seek for a record of 12 to 1 as much as a practice that will produce good, uniform, fluid iron; with him the exact condition of the iron is of vast importance and 9 to 1 with good iron is far preferable to 12 to 1 and have the iron doubtful, while heavy work can be made from iron that does not require attention in the same direction. Some firms use all pig iron and express wonder at not being able to show records similar to others, who, no doubt, are using from 50 to 75 per cent. scrap, probably a great portion of it stove plate or light machinery. Some use an inferior grade of coke and expect the best results.

Many times a good record is questioned and considered false by those who do not equal it. They never stop to investigate their own fixtures, and see if they are all in proper shape, or if the management or manipulation of the cupola is based on the principles of melting iron, and not "guess work" of the cupola tender.

All these things constitute a part of the variety of ideas on economy, and nearly everyone in the business has one or more of these obstacles to overcome, and naturally their study and experimenting will be in that direction, because they require it most, while others who do not meet the same stumblingblocks would consider records of melting accomplished under difficulties they know nothing of as commonplace and ordinary.

Economy, as I understand it, is the cheapest way of executing work, at the same time maintaining its quality. If three or four dollars worth of fuel extra will decrease the time of melting, so the molders can produce twenty dollars worth more work, that is true economy. Or if fuel is cut too close or the cupola run carelessly, and the iron comes dull and loses twenty dollars through work that did not run, that is not economy, even though a cupola record of high merit is shown. Every cupola must be run to suit the conditions and facilities, and no individual record is worth the paper written on to foundrymen unless the conditions are known and judgment used to obtain similar results. No cupola can obtain the highest possible efficiency in all directions—have the best record for ratio of fuel, time, blast pressure and condition of iron. It is impracticable for many reasons, but judicious management will often bring the results near.

Neither can a ten-ton heat be melted as economically in a forty-inch cupola as in a thirty, but time is worth more than the four or five hundred pounds of fuel saved on the bed in many cases, and again the highest ratio of fuel is impracticable.

Some men in showing their records quote what they use between charges, leaving the bed out or charge for lighting fire, as they term it, and show results that are some times misleading. If only one charge was melted, and that on the bed, I presume their record would be 1,500 to nothing, or whatever they used in the first charge of iron. In some ways, though, this method of figuring is good. It gives a basis to record a heat of any length without the bed making any difference, and shows what the cupola will do independent of it, but a short heat cannot be judged safely in this manner, for a heavy bed will support three or four charges melted with insufficient fuel between them.

The actual bed should never be lost sight of, for it is the most important factor in charging and in the successful management of the cupola.

Another item often omitted in records of melting is how much iron was dropped with the bottom. Often a ton of iron will be dropped through, and the record show that ton to be melted, which is not fair practice.

Some cupolas require a heavier bed than others; for example, a cupola built with low tuyeres, where the iron is taken as fast as melted, does not require the same amount of fuel for a bed that one built to hold twenty or thirty hundred of iron below the tuyeres would. Yet the cupola with the high tuyeres is probably the most economical, for it mixes the iron better and permits the use of more scrap or pig iron of poorer quality than the one that runs continually.

A cupola may also be placed in a part of the country where the altitude is high, say, seven or eight thousand feet above sea level, and the conditions of blast pressure vary greatly, as will also the melting, and wonder may be expressed as to why it does not equal what is done in other localities.

They will say: "We use the same formula of charging, cupola, fuel and everything, but can't obtain results." Neglect to study the individual condition is the cause of their failure. The same thing is often true of patent cupolas; they will be erected and run according to the formula laid down by the patentee, but fall short of the claims made for them, and the actual work they have done in some other locality, and why? Some little difference in erection, blast pressure or fuel used, some little carelessness from the cupola tender, or some misunderstanding of the formula of working, coupled possibly with ignorance of the principles of the art will account for the cause in numberless cases.

I do not assume that all cupolas can be made to work exactly alike, but there should be a closer relation in results than we are obtaining at present.

I can say unreservedly that the cupolas in our country that are run at a ratio of one to seven and one to eight are not being run economically, and those in charge do not thoroughly understand their business unless the heats are very light, but, as before stated, circumstances will vary results, but the wide difference in practice is not only unnecessary but wasteful.

Progress is rapidly being made in this business, and cupola practice is becoming an art that has its devotees as surely as any other. To keep up with this march of improvement requires the constant study of those connected with the business, and they must do it if they expect to equal the results of others who give it their time and attention. It is not so much a question of patent or new cupolas, as the management of and improvements applied to those we now have. Many of our patent ones are excellent, but lose their greatest efficiency through lack of knowledge and common

sense in management. The way a cupola is handled or run is the entire foundation on which its truest economy is based.

An Age of Combine.

At a meeting of the "Workingman's Club," in New York, President Seth Low, of Columbia College, took a cheerful and philosophic view of things and said:

The student in the university who studies abstract subjects is as much a workingman as the mechanic. Each fills his place. To make a success of anything you must have your heart in your work, and so I say, love such work as Providence has allotted you. A spirit of unrest is now abroad, but in the light of history it ought not to alarm us. This unrest is really the result of the marvelous progress of the last twenty years, for it is a remarkable fact that in that time 50 per cent. of the standing capital of the country has been rendered valueless, and 40 per cent. of the workingmen have had to change their occupations.

In this country the laborer is equal to the President—each is entitled to one vote only, but it is the tendency of this age for the individual to lose himself in association. The laboring man joins the labor union, the rich man the trust. Really this is an age of combine. Society has not yet adjusted itself to this state of things, but when it will have done so, depend upon it, this unrest will disappear.

A man who signs himself W. A. C., and gives neither his name or his location, sends us a tracing of a structure which he proposes to erect, and wishes us to give him an opinion upon it. If he will send us his name and address, the matter may be attended to.

U. S. Labor Commissioner Carroll D. Wright, in a recently delivered address, stated that one of the witnesses before the strike commission at Chicago summed up the situation in this way:

"The man who gets $1 a day wants $1.25; he who gets $5 wants $10; he who gets $5,000 a year wants $10,000, and he who gets $50,000 wants the earth."

MANUFACTURES.

It is reported that S. D. Warren & Co. will build a mill on their East End property at Westbrook, Maine, for the manufacture of chemicals.

The frame work of the Stillwater Manufacturing Company's new shop at St. Paul, Minn., is now almost completed, and the machinery will be put in the latter part of next week.

The new paper-mill being built at Jay Bridge, Maine, on the Androscoggin, by the Jay Paper Manufacturing Co, will probably be ready for running by May, and will have a daily capacity of about 25 tons.

A large force of workmen are now engaged at North East, Md., rebuilding the sheet and bar-mills of the McCullough Iron Company, which were destroyed by fire several weeks ago. The new buildings will be quite an improvement over the old ones.

Luke F. Shinners, Joel H. Fuller, Charles B. Stone, Charles H. Stewart, and Henry C. Bunts, of Cleveland, Ohio, have been granted articles of incorporation as the American Smokeless Furnace Company, of Cleveland. It will manufacture and deal in furnaces and in patents relating thereto and will erect furnaces and boiler plants. The capital stock is $25,000.

The Brady Manufacturing Company, York, corner of Washington street, Brooklyn, N. Y., has sold the heavy machinery on the street floor of their factory, and leased the room to the Thompson-Low Manufacturing Co., of 15 to 25 Whitehall street, New York City. Besides manufacturing their specialty—dish washing machinery and other articles for hotel and restaurant use—they have added facilities for the design and construction of special machinery and tools for interchangeable work. Mr. A. J. Wilson is the superintendent of the shop.

The Belknap Motor Company, Portland, Maine, report busy times. The Shaw & Morse Lumber Co., of Bangor, have just placed their order for a 150 light plant; Perkins & Danforth Spoolwood Company, of Norcross, a 40-light plant complete; John McGregor, of South Lincoln, a 150-light plant; Scamman's new toothpick factory in Deering, a 40-light plant; Clark & Chaplin Ice Co., a 40 light plant; Richardson Wharf Company, a 5 horse-power motor; Kennebec Light and Heat Company, a 4-horse-power motor. The Stanley Electrical Manufacturing Company, of Pittsfield, Mass., have placed their orders with the Belknap Motor Company for 22 dynamos for exciters for the last four months. These machines are from 1 to 15 K. W.

The Tradesman, Chattanooga, Tenn., in its report on the industrial condition of the South for the week ending December 3d, says: The interest in phosphate mining is increasing, two large corporations for that purpose having been formed during the week. Textile mills are also increasing in number, and the iron producers are working on full time and to the full capacity of their plants. Coal mining is fairly active but, as in other lines of business, prices are very low. Lumber men report that trade with them is slowly growing better. Immigration to the South is increasing. Several companies have recently been formed to promote immigration, others will be formed, and the railroads are doing much in the same direction. Twenty-nine new industries were established or incorporated during the week, together with nine enlargements of manufactories, and nine important new buildings. Among the new industries of the week are: The Peace River Phosphate Co, of Savannah, Ga., capital $1,250,000, and the Associated Phosphate Co., of Ocala, Fla., capital $250,000; the Golden Valley Colonization Co, of Little Rock, Ark., with $1,000,000 capital; the La Port Land Co., of La Port, Tex., capital $600,000, and the Suburban Light and Water Co., of Wheeling, W. Va., with $500,000 capital. A $100,000 sugar refinery is to be built at St. Martinsville, La., and one is reported as to be built at Tallahassee, Fla.; the Cigar Wrapper Co., with $50,000 capital has been chartered at Wheeling, W. Va.; the O. P. & B. E. Willingham Woodworking Co., capital $25,000, at Macon, Ga.; the Louisville Malting Co., with the same capital, at Louisville, Ky., and the Chatham Electric Light and Power Co., capital $25,000, at Savannah, Ga. There is to be an agricultural implement works at Troy, Ala., and Wheeling, W. Va.; canning factories at Paducah, Ky., Holly Springs, Miss., Abbeville, S. C., and Galveston, Tex., and cotton-mills at Salem and Winston, N. C., and Columbia, S. C. Ice factories are to be built at Georgetown, S. C., and Winchester, Va.; a starch factory at Charleston, S. C; a tannery at Piedmont, Ala., and woodworking plants at Summerville, Ga., Carpenter, Miss., and Asheville, N. C. Water works costing $100,000 are to be built at Selma, Ala.

Machinists' Supplies and Iron.

NEW YORK, December 8, 1894.

Iron—American Pig—We quote standard brands, $12 to $12.50 for No. 1; $11 to $12 for No. 2, and $10.50 to $11 for No 2 Plain. Southern brands, $11.25 to $11.50 for No. 1; $10 25 to $11 for No. 2; $10 to $10.50 for No. 3; $10.50 to $10.75 for No. 1 soft; $10,25 to $10.75 for No. 2 soft; and Foundry No. 4, $9.75 to $10.25.

Antimony—A fair business has been done in the jobbing line. We quote L. X., 8c. to 8¼c.; Cookson's, 8½c. to 8¾c.; Hallett's, 7.35c. to 7½c.; and U. S. French Star, 9¼c. to 9½c.

Lard Oil—Prime City we quote at 55c. to 56c.

Copper—The market is firm, with a fair demand for immediate use. For Lake Copper 10c. is asked, but business has been done at 9.50c. Casting Copper is held at 9.25c. to 9.30c.

Lead—The market is dull and irregular. Spot lead is quoted at 3.15c. to 3.17½c. for New York delivery.

Spelter—The market is easy, with a tendency towards lower prices; for New York delivery 3.27½c. is quoted on spot.

Tin—The downward tendency of prices continues. There are sellers at 13.60c., and 13.50c. is about the best cash bid on round lots.

DAMPER REGULATORS.

Our hydraulic damper regulator we guarantee as good as the best, in every point. It is also an ornament to any engine room.

MASON REGULATOR CO., Boston, Mass.

BUFFALO DRILLS. FOR BLACKSMITH, CARRIAGE & WAGON MANFRS. 24 SIZES. BUFFALO FORGE CO. BUFFALO, N.Y. U.S.A.

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BY W. H. FORD.

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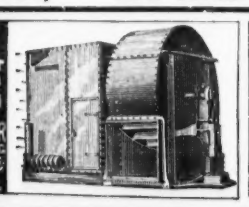
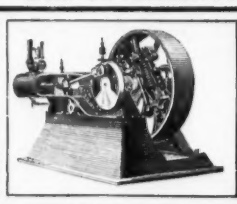
60-INCH SWING, TWO HEADS.

Modern Style, in Good Order, and will be sold Very Low before moving.

BOX 62 AMERICAN MACHINIST.

THE STURTEVANT PATENT HOT BLAST STEAM HEATING APPARATUS. COMBINED STEAM FAN & HEATER FOR VENTILATING AND DRYING. SEND FOR CATALOGUE. B.F. STURTEVANT CO. BOSTON, MASS.





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THE F. F. COMPRESSION COUPLING. Quickly attached or detached. No key-seats. Simple, cheap and thoroughly reliable. Send for circular. LINK-BELT MACHINERY CO., Chicago, U. S. A.

SWEET'S Measuring Machine. The only micrometer that will not lose its accuracy by wear. Satisfaction Guaranteed, SYRACUSE TWIST DRILL CO., Syracuse, N. Y.

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ARE SUPERIOR TO LATHES FOR FACE PLATE WORK.

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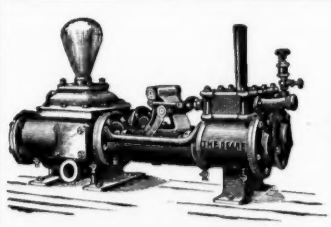
E. P. BULLARD, Pres't. BRIDGEPORT, CONN.

New York Office, 86 LIBERTY STREET.



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ADJUSTABLE PLATE AND MACHINE DIES.

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SAVES LABOR in being able to run at GREATLY INCREASED SPEEDS. FEWER GRINDINGS. No WASTE in redressing.

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BOSTON: 11 & 13 Oliver St., NEW YORK: 143 Liberty St

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We Were Not Awarded a Medal at the World's Fair,

because our tools were not on exhibition there but our customers write us that every tool built by us has proven exactly as represented. Our claim is that "Our tools are of the latest and most approved designs, while the workmanship, material and finish are of the highest order." Our catalogue will tell you all about them. Prices quoted on application. No time like the present to buy!

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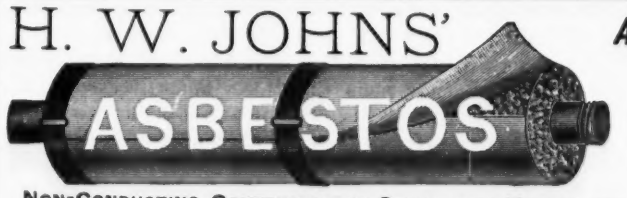

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NON-CONDUCTING COVERINGS FOR STEAM AND HOT WATER PIPES, BOILERS, ETC. ASBESTOS BOILER COVERINGS.

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✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

A practical machinist & designer, wants pos. selling & erecting machinery. Box 63, AM. MACHINIST.

A patternmaker desirous of making a change, wants pos.; A1 refs. Box 65, AMERICAN MACHINIST.

A1 draftsman & mech. engineer, graduate, wants permanent position. M. E., Box 66, AM. MACHINIST.

Draftsman would like steady employment; refs. from former employers. Box 68, AM. MACHINIST.

Wanted—Position as patternmaker; best of references; cylinder work pfd. J. F. P., AM. MACH.

Foreman patternmaker wants "change," 20 yrs' exp.; best refs.; corres. solicited. Large shops. Box 59, AMERICAN MACHINIST.

If you are manufacturers and want a good traveling salesman having experience, trade, and A1 refs. Address Want, care AMERICAN MACHINIST.

Young man, exp'd in design & costs of hydraulic tools & hoist'g mach'y, wants change. A. R. S., AMERICAN MACHINIST.

Wanted—Foremanship of machine or other shop, by man of practical experience; good at making appliances for quick work. Box 69, AM. MACHINIST.

Wanted—An experienced traveling man to sell duplex steam pumps; give experience and salary required. Gardner Governor Co., Quincy, Ill.

Mech. engineer and draftsman, 12 years' experience in Web printing presses and folding machines, is open for engagement; A1 refs. P. 40, AM. MACH.

Wanted—Superintendent for machine shop, manufacturing pulp and paper mill machinery. Iron and brass foundry connected. Located in a small New York town Box 60, AMERICAN MACHINIST.

Wanted—Pos as supt. or chief draftsman; a thorough mechanic, versed in modern methods and design, machine tools, rolling mill, wire working, sheet metal, hydraulic and special machinery; American; age 37. Box 64, AMERICAN MACHINIST.

Wanted—Position by mech. eng'r and draftsman, as ass't. supt. or chief in drawing room; 15 years experience in office and practical work on engines, boilers, sugar machinery and steam plants. Box 67, AMERICAN MACHINIST.

Wanted—A thoroughly competent man as foreman of the tool makers' room of a factory devoted to the production of small fine interchangeable work; he must be thoroughly well up on modern methods of work and of good executive ability, and know how to work well and in reasonable time; steady position for right man; give reference and state experience. X., AMERICAN MACHINIST.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers. S.M.York, Clev'd, O.

Best Steel Flue Scrapers. Kelley Co., Erie, Pa.

Callpers & Gauges. F. A. Welles, Milwaukee, Wis.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Co., Cincinnati, O.

Light and fine mach'y to order; models and electrical work specialty. E. O Chase, Newark, N. J.

Wanted—To buy good second-hand tools. Box 83, AMERICAN MACHINIST.

Draftsmen's new knobbed combination triangles, stencils, etc. D. J. Kelsey, New Haven, Conn.

Model Locomotive Castings. Latest design. G. H. Olney, 163 Herkimer street, Brooklyn, N. Y.

Every mechanic should have a copy of "Pocket Primer of the Air Brake." Sent to any address for 50 cents. W. S. Rogers, Buffalo, N. Y.

Wanted—Plans for a steam laundry. Piotrowski & Co., Annonsen Bureau, Senatorska, 26, Warschau, Russia.

DON'T ACCEPT ANY SUBSTITUTE FILE.
INSIST ON HAVING
NICHOLSON.

NICHOLSON FILE CO.
PROVIDENCE, R. I., U. S. A.
3000
VARIETIES FILES
[X. F.] & INCREMENT CUT FILES.

LECOUNT'S NEW EXPANDING MANDREL.

Amateur's Size.
Taking anything from ⅛ to 1 inch inclusive.
Price.....$5.00
Patented Dec. 25, 1877.

Machinist's Size.

No.				Price.
1	⅛ to 1	in.		$10
2	1	"	1½ "	14
3	1½	"	2 "	18
4 (with screws)	2	"	3 "	32
5 " "	3	"	4 "	44

IF YOU WILL TRY THIS TOOL YOU WILL NOT REGRET THE EXPENSE.
C. W. LECOUNT, SOUTH NORWALK, CONN.
SPECIAL MANDRELS FOR SPECIAL JOBS MADE TO ORDER.
These goods are for sale by CHAS. CHURCHILL & CO., L't'd. 21 Cross St., London, England.

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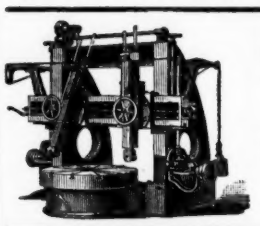

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14 SIZES FROM 5 TO 20 FEET.
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Manufacturers of Set, Cap & Machine Screws, Studs, etc.

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ALL KINDS IN STOCK.
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"Star" Foot Lathe Swings 9x25 in.
LATHE
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Scroll Saws, Circular Saws, Lathes Mortisers.
Catalogue Free of all our Machinery.
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DROP PRESSES·DROP HAMMERS·STAMPS
OR AUTOMATIC DROP LIFTERS·
SEND FOR CATALOGUE TO
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LARGEST LINE IN MARKET.

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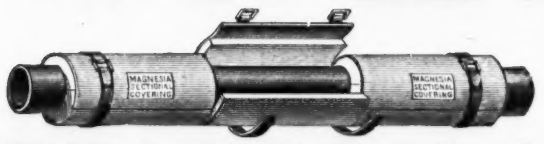
ABSOLUTELY FIRE-PROOF.



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Baltimore, Wallace & Bro., 432 E. Pratt St.
Washington, Wm. B. Morgan, Builders' Ex'e.
New Orleans, Delbert Engineering Co.
Memphis, Symmes & Co., 192 Front St.

CINCINNATI: 114 West Second Street.
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St. Louis, F. Boecler, 108 Walnut St.
Detroit, S. P. Conkling, 20 Atwater St., East.
Denver, C W. Badgley & Co., 18th & Market Sts.
Salt Lake City, Utah & Montana Mach'y Co.
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In order to reduce stock before our annual stock-taking, we have decided to make special **LOW PRICES** on such new and second-hand tools as we have in stock, if ordered on or before January 10, 1895. **WE MEAN BUSINESS.** Send for list and state what tools you are in the market for.

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BUILDERS IRON FOUNDRY,
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Planer, 28 in. x 24 in. x 7 ft., new.
Drill Press, 40 in. swing, new.
Engine Lathe, 24 in. x 25 ft. bed, 2d hand.
Roots' Blowers, Nos. 1, 2, 5 and 6, "
Haskin Vertical Engine, 9 x 9, "
Vertical Boiler, 30 H. P., "
Open-die Bolt Cutter, ¼ to 1¼, "
Planer 14 in. x 10 in. x 30 in., "
Band Saw, 36 in., new.
Write us before buying.

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Machinery and Supplies,
163 and 165 WASHINGTON ST.,
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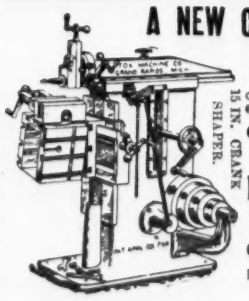

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Length of stroke changed INSTANTANEOUSLY while IN MOTION.
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Slow speeded, Force-blast, Durable, Compact and Cheap.
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In Writing, Please Mention This Paper.

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FOR ALL DUTIES.

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CLEVELAND, 24 South Water St.
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ST. LOUIS, Eighth and St. Charles Sts.

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No More Twisted Tangs.

Larger drills can be used with smaller shanks than ever before. No charge for the groove in the shanks.

Send for Descriptive Price List.

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DETROIT TWIST DRILL CO., DETROIT, MICH., U. S. A.

SOLE MANUFACTURERS OF

GRAHAM'S GROOVED SHANK TWIST DRILLS AND CHUCKS.

Endorsed by Practical Mechanics Everywhere. Send for Catalogue

ALL THE MACHINERY IN A LARGE ENGINE AND MACHINE TOOL SHOP

will be sold (separately) at

LOW PRICES BEFORE REMOVAL.

Jones & Lamson 2 x 24 Flat Turret Lathe with large assortment of Tools. A1 order.
Gould & Eberhardt Universal Auto. Gear Cutter 30 in. for Spur and Bevels—with Cutters, Arbors, etc. A1 order.
Brainerd No. 3 Standard Universal Milling Machine complete, with Universal 16 in. Centers, Cutters, Arbors, etc.
Brainerd No. 4 Standard Milling Machine with Cutters and Arbors
Engine Lathes, "Prentice," "Flather," "Lodge & Davis," "Gleason," Putnam and "McMahon" Sizes 14 to 30 in. swing.
Upright Drills, "Pratt & Whitney" and "Blaisdell." Sizes 20 to 28 in. swing.
Planers, sizes 16 to 32 in. wide.
Shapers, sizes 16 to 22 in. stroke.
Bolt Cutter, "Schlenker" 1⅛ with Taps and Dies.
Punch and Shears, "Long and Allstatter" combined machine.
Bradley Hammer, 40-pound.
Patternmakers' Tools, Saws, Lathe and Planer, Tool Reamer and Cutter Grinders.
Key-seating Machine, Buffing and Emery Stands, Small Tools, Belting, etc.

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SUCCESSOR TO E. P. BULLARD'S N. Y. Mach'y Warerooms. | 14 Dey St., NEW YORK.

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ENGINE LATHES.

12 in. x 4 ft. Manhattan Co.
14 in. x 6 ft. Old Style.
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24 in. x 12 ft. Special heavy pattern.
24 in. x 16 ft. New Haven.
24 in. x 38 ft. Shafting Lathe.
27 in. x 22 ft. Morris.
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TURRET LATHES.

12 in. and 15 in. Lever and Screw Movement to Turret.
18 in. Turret Chucking
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PLANERS.

24 in. x 24 in. x 8 ft. Lodge & D.

DRILL PRESSES.

20 in. Lever Drill.
24 in., 28 in. and 34 in. B. G. P. F. Drill.
52 in. Comb Radial.
120 in. Radial.
Henley Swing Drill.

MISCELLANEOUS.

2 No. 1 Garvin Tapping Mach.
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1 Open Die Header for Heading Bicycle Spokes.
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New Imp'v'd Engine Lathes.
Turret, Brass Working and Pulley Machinery.

THE LODGE & SHIPLEY M. T. CO.,

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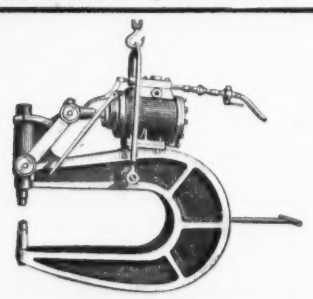

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Pneumatic Rivetters and Air Compressors

DE BERQUE & CO., Manchester, England.

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Chicago Office, 100 W. Washington Street.

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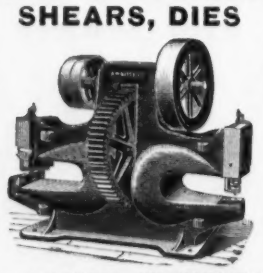

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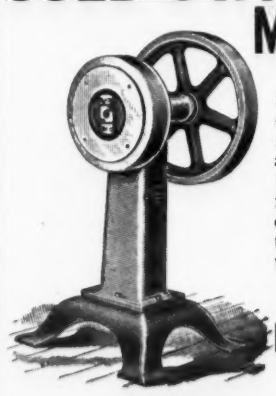

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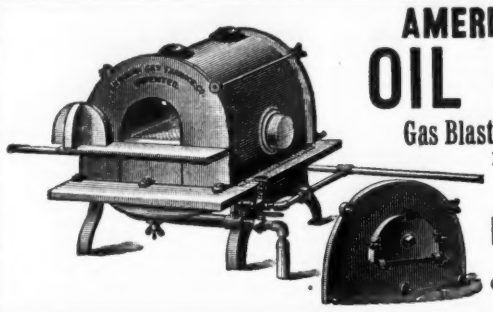

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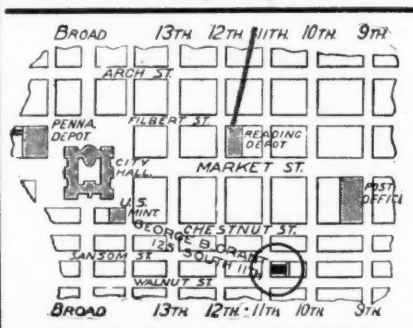

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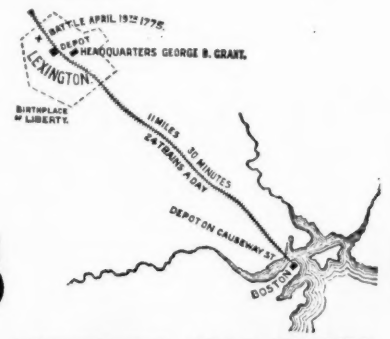

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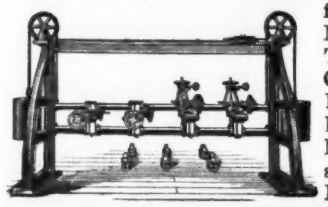

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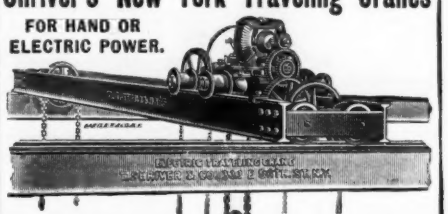

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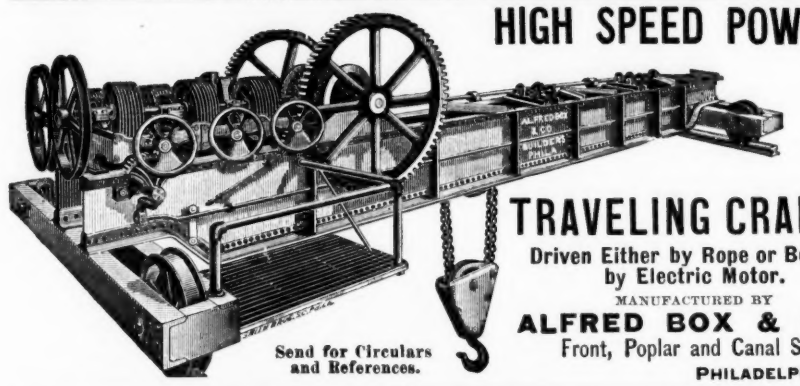

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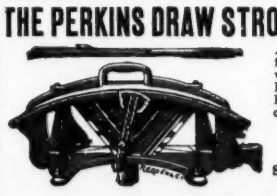

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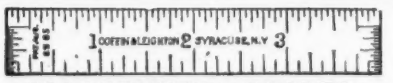

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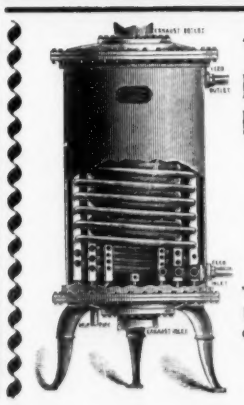

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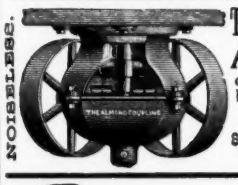

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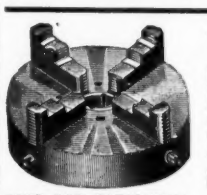

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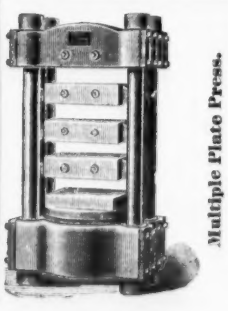

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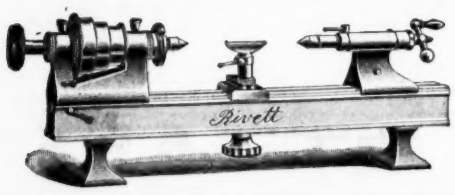

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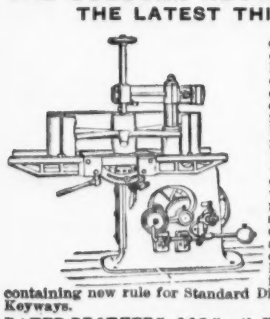

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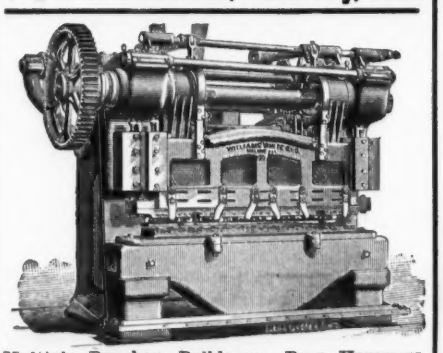

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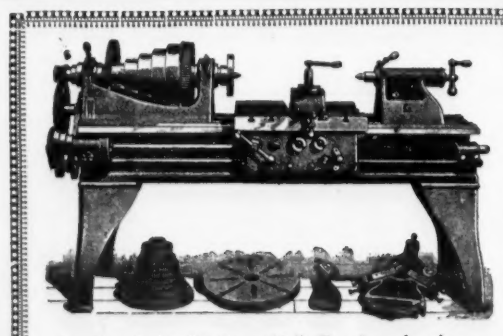

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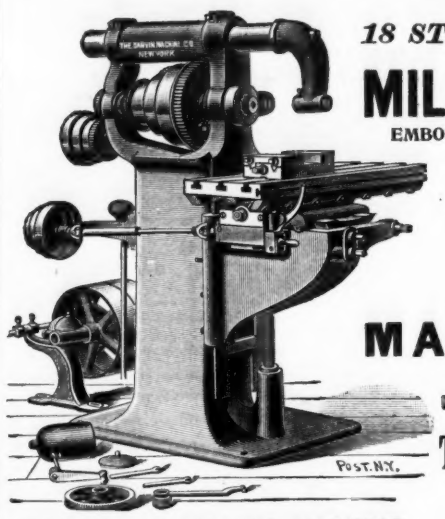

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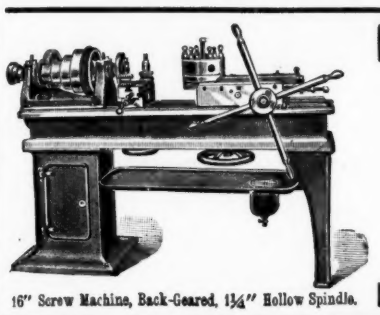

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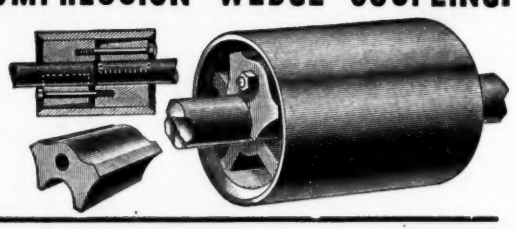

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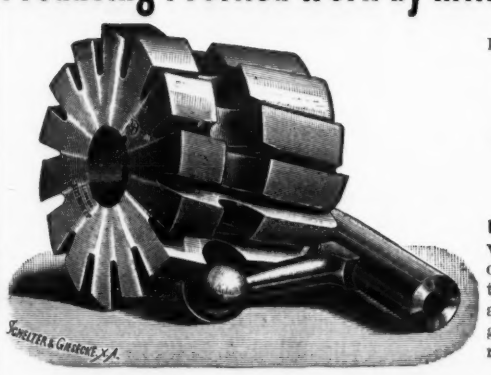

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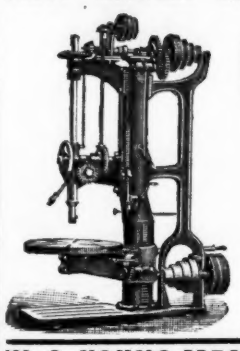

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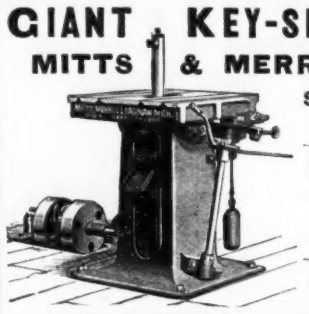

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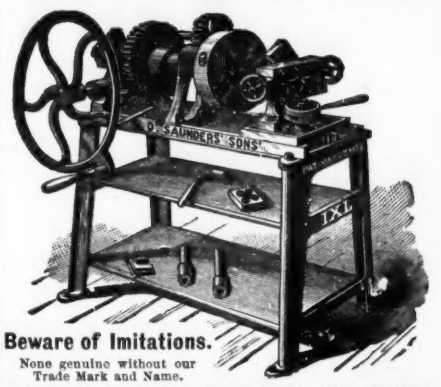

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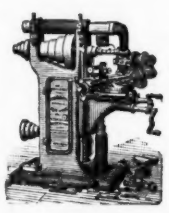

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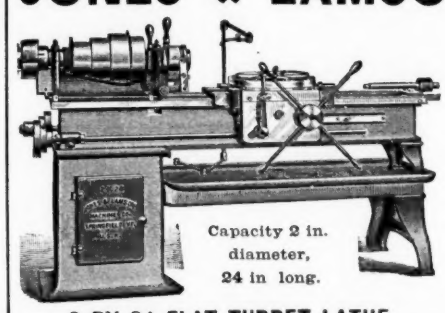

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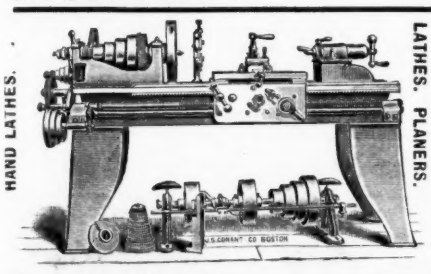

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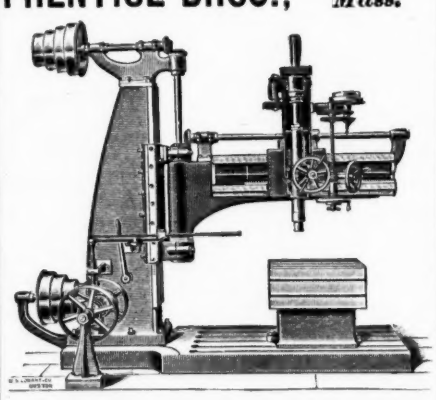

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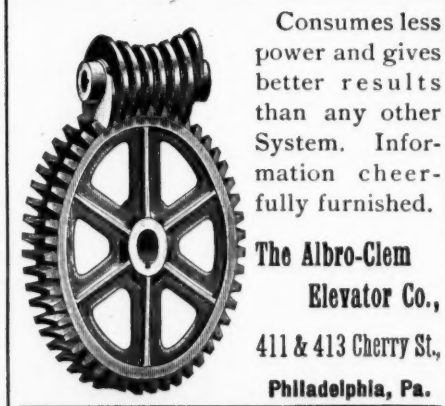

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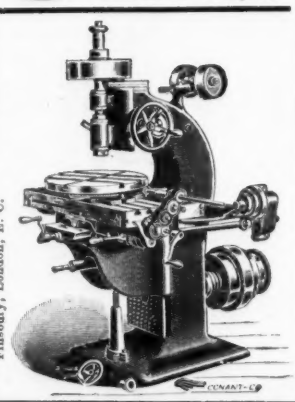

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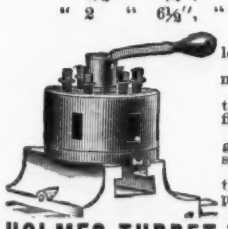

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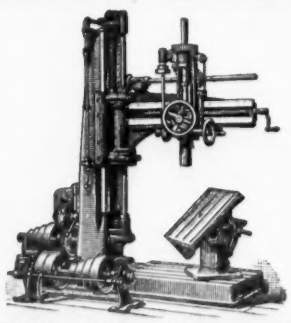

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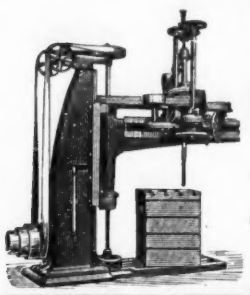

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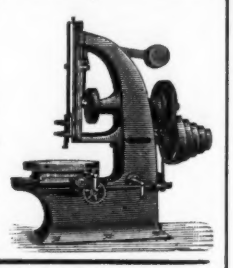

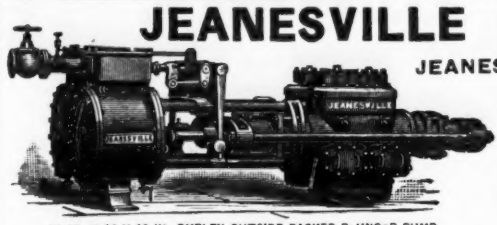

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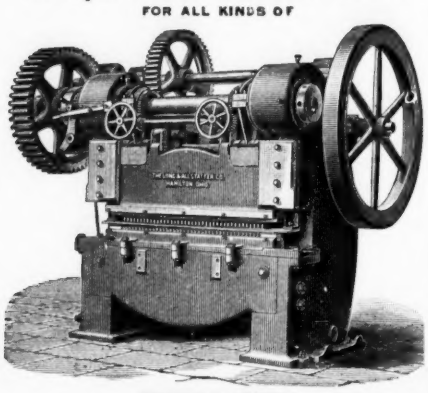

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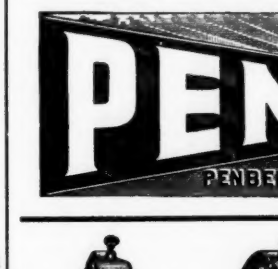

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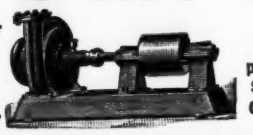

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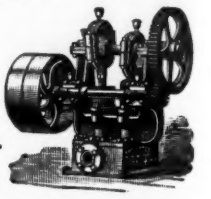

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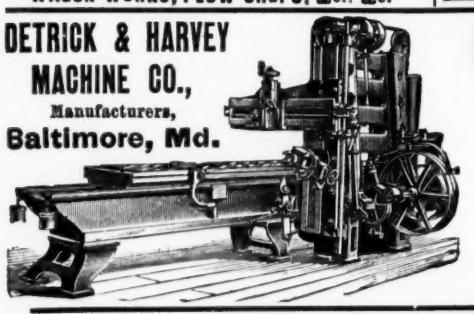

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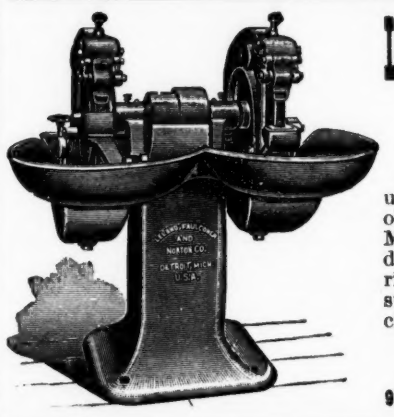

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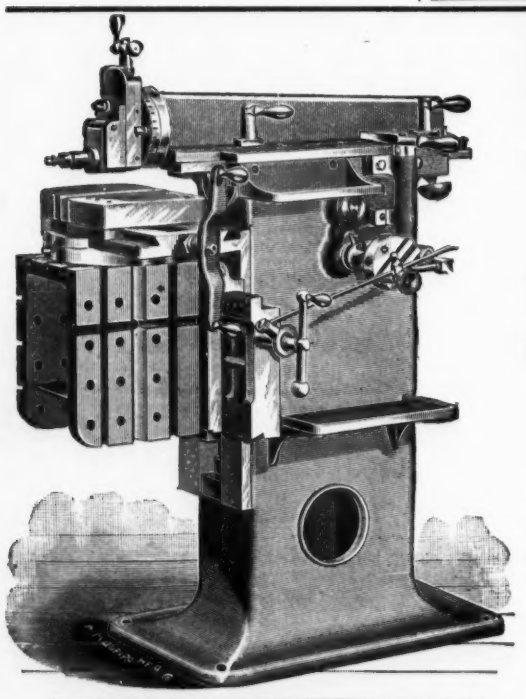

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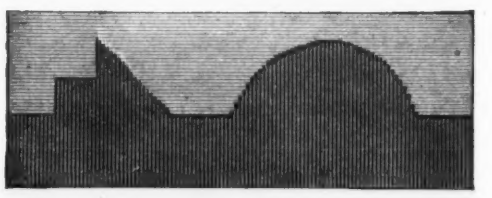

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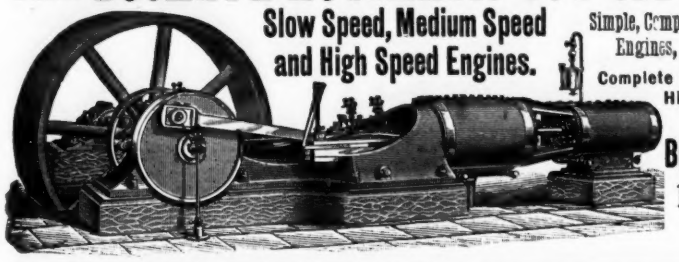

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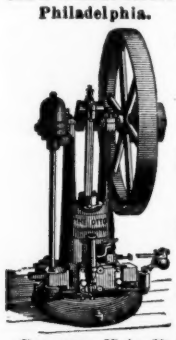

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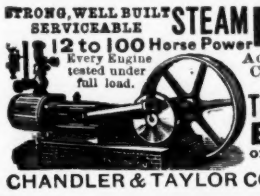

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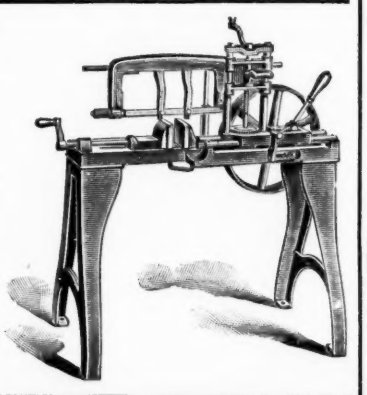

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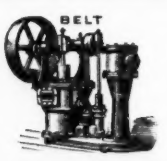

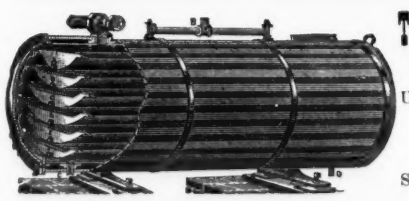

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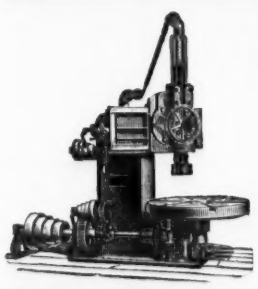

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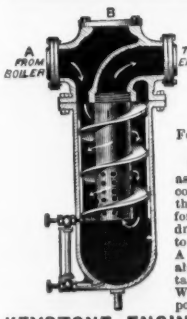

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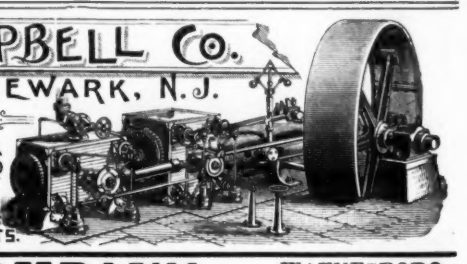

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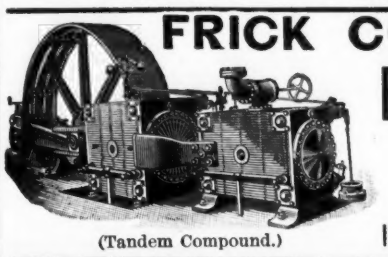

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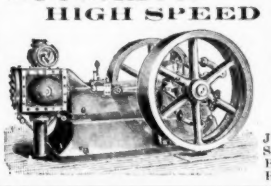

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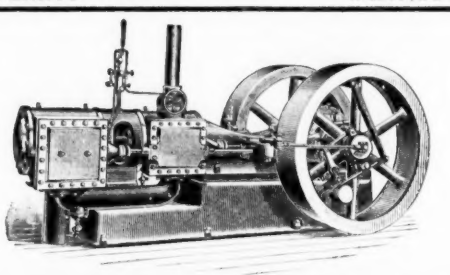

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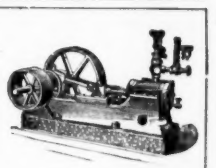

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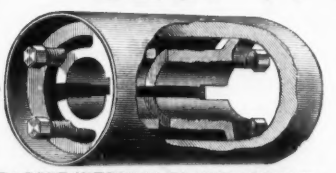

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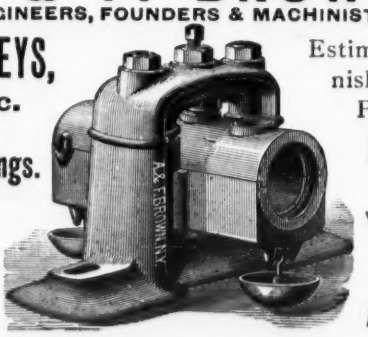

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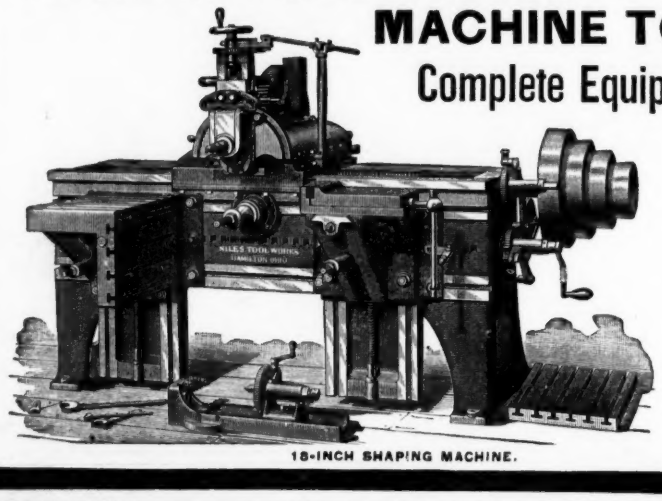

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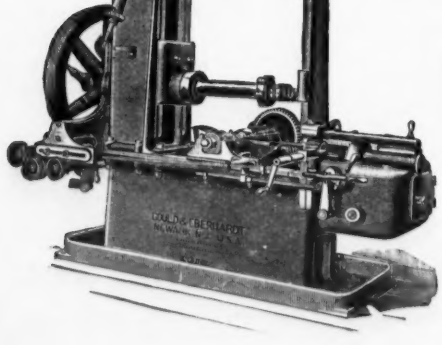

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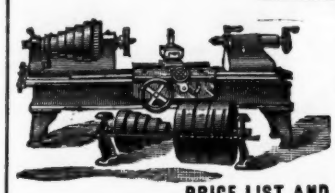

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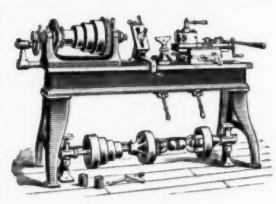

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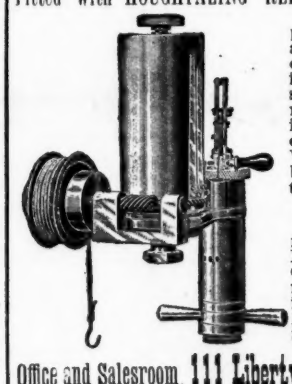

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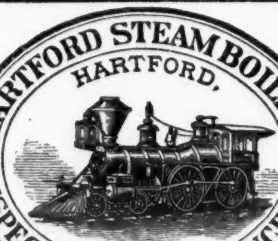

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